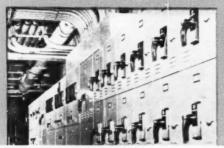
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



NEW SWITCHBOARD replaces old with no break in electric service.



SERVICE TRUCK equipment expedites lighting maintenance operations.



HIGH-CYCLE TESTING gives turn-to-turn voltage stresses without excessive currents.



LOW FRESNEL lensed pedestals light Shasta Dam abutment area.

MAKE THIS ONE-MINUTE CHECK ON YOUR PLANT VOLTAGE

ype of Equipment	Effect of undervoltage	Effect of overvoltage
Incandescent Lamp Bulbs	10% undervoltage cuts light output 30%—slows production.	10% overvoltage cuts lamp life 70%—triples replacements.
A-C Motors	Causes overheating — increases maintenance costs.	Decreases power factor—increases power costs.
Resistance Heaters	10% undervoltage cuts heat output 19%—slows production.	Causes severe overheating — high replacement costs.
Electronic Devices	Drastically cuts tube life. May destroy gas-filled tubes.	5% overvoltage cuts tube life 50%—high replacement costs.
Infrared Processes	Lengthens process time — slows production.	Causes blistering or scorching—increases manufacturing costs.

This chart shows how poor voltage drags your plant efficiency down

Keep your production up by keeping the right voltage with G-E Inductrols

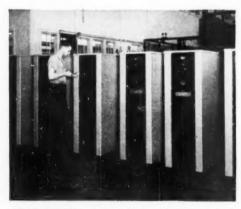
A quick look at this chart tells you why it pays to operate your equipment at correct voltage.

When voltage sags, the efficiency and output of your equipment drop sharply—maintenance costs go up. When voltage rises above the correct value, it shortens the life of your equipment—increases manufacturing and replacement costs.

You can eliminate the problems of undervoltage and overvoltage by installing G-E Inductrols. These new dry-type regulators automatically maintain correct voltage for your a-c electric equipment and assure peak operating efficiency.

They can be installed almost anywhere. They're housed in attractively styled, all-steel cabinets that protect plant personnel by completely enclosing all live parts.

For additional information on G-E Inductrols, contact your local G-E Sales representative or authorized agent. Or write for bulletins GEA-5824, GEC-795, and GET-2351. General Electric Company, Schenectady 5, New York.



WIDE RANGE of G-E Inductrols covers both manual and automatic operation, single- and three-phase applications. Standard automatic regulators include ratings from 3 kva, 120 volts to 500 kva, 600 volts. Here workman prepares single-phase units for final test prior to shipment.

G-E Inductrols are ideal for light-dimming applications



ANOTHER NEW

Murray **PRODUCT**



Cat. No. PC316A List Price - \$74.00

Five Models to Choose from in either surface or flush.

HERE'S APackaged so TO INCREASING LOADS

Murray's "Combination" units will solve your main switch and distribution panel problems—

THEY PROVIDE BOTH SERVICE ENTRANCE AND BRANCH DIS-TRIBUTION IN ONE UNIT.

These Murray "Combination" service entrance and branch distribution units provide 100 Ampere main circuit breaker, fusible range and water heater pullouts, lighting and appliance plug fuse branch circuits - with or without a dryer pulloutl

2 THEY PROVIDE FOR GROWING ELECTRICAL LOADS.

Any one of these five compact units offers a packaged solution to increasing loads. They are ideal for small commercial and large residential installations.



THEY SAVE TIME AND MONEY IN INSTALLATION.

Murray "Combination" units will save you time and money all along the line. Just one unit to buy - just one unit to install - just one unit

Factory bussing makes these units easy to wire. There's plenty of wiring room and all K. O's are conveniently located. Hook-on cover uses only two screws. Compact! Only 12-% inches wide, designed to fit between building studs.

THEY GIVE DEPENDABLE CIR-CUIT PROTECTION AT ALL TIMES.

Fully magnetic circuit breaker main consists of independent trip, 1 pole, 100 Ampere 120/240 volt AC fully magnetic circuit breakers. Carries full rated load continuously, Handle bar permits simultaneous manual tripping to 'off'

Murray's well-known fusible pull-out construction provides positive electrical contact. One piece fuse clip and blade prevents overheating.

Cat. No. PC212A

8日

B

- 100 Ampere main, fully magnetic circuit breakers
- 60 Ampere range fusible pullout
- 30 Ampere water heater fusible pullout 12 plug fuse branch circuits
- List Price \$57.00

Cat. No. PC216A

- 100 Ampere main, fully magnetic circuit breakers
- 60 Ampere range fusible pullout
- 30 Ampere water heater fusible pullout
- 16 plug fuse branch circuits List Price - \$64.00

Cat. No. PC220A

- 100 Ampere main, fully magnetic circuit breakers
- 60 Ampere range fusible pullout
- 30 Ampere water heater fusible pullout
- 20 plug fuse branch circuits

List Price - \$71.00 Cat. No. PC312A

- 100 Ampere main, fully magnetic circuit breakers
- 60 Ampere range fusible pullout
- 30 Ampere water heater fusible pullout
- 30 Ampere dryer fusible pullout 12 plug fuse branch circuits
- List Price \$67.00

Cat. No. PC316A

- 100 Ampere main, fully magnetic circuit breakers
- 60 Ampere range fusible pullout
- 30 Ampere water heater fusible pullout
- 30 Ampere dryer fusible pullout
- 16 plug fuse branch circuits

88 List Price - \$74.00

MURRAY MANUFACTURING CORPORATION 1250 ATLANTIC AVENUE . BROOKLYN 16, N.Y.

Service Entrance & Meter Equipment • Fully Magnetic Circuit Breakers • Switches (Types A, C and D)

Current Limiting Reactors . Crows' Nest Aerial Ladders

APPLETON REELITE Positive Safety

FOR PLANT AND PERSONNEL

Automatically Takes Up, Pays Out Conductor Cable Keeps Cord Reeled Up Safely Out of the Way



any direction. Mounted at the mid-point, a Type "YS" Reelite equipped with 45 feet of cord will serve a stretch of track 90 feet long, straight or curved.

The Type "YS" Reelite eliminates the necessity for exposed current collectors, trolleys or wires. Outer cover easily removed to service brushes and power spring, or to make solderless line connections direct to terminal block. Oil-less bearings at all points of rotation.

RATING: 15 Amperes, 550 Volts A.C.; 250 Volts D.C.

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

1704 Wellington Avenue . Chicago 13, Illinois

Field Engineers in all Principal Markets

SEND TODAY for free copy of new Bulletin 504. Fifty full pages describing Appleton Reelites shown here, plus special types and combinations for power tools, air and liquid lines.



Here's the new, all new, Appleton 7S Portable Reelitean automatic cord reel that takes light right where it's needed, in carloading, stock-keeping, machine inspection, building maintenance-on hundreds of jobs that require bright, safe, movable illumination. Now equipped to swivel continuously in either direction. Keeps cord reeled up out of the way. Positive stop action holds cord at desired length-re-reels cord when job is done. Available accessories include six types of hand lamps, machine tool connector body or key socket.

CONSTANT DUTY TYPE FOR HEAVY JOBS

Carries smooth, uninterrupted power to moving electrical machines. Automatically winds up and pays out rubber covered cable to cranes, hoists, elevators, lifting magnets, generator setsheavy mobile equipment of every kind. Pays for itself in efficiency, safety, cable protection.





CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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GENERAL-PURPOSE CONTROL

Fhp motor



1-7½ h manual ma tor starters



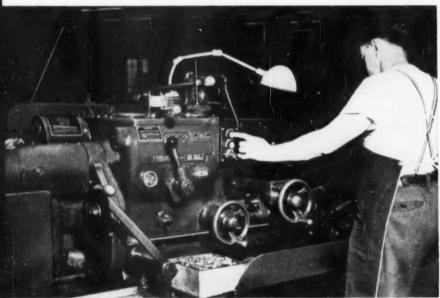
A-c magnetic motor starter







New G-E Oil-tight Units — Modern Design for Modern Machines



Machine operation is easier with these G-E units that retain color identification under continual use

LONG ELECTRICAL LIFE:

Unique self-a-line contacts assure equal distribution of arcing on the double-break contacts which prevents excessive and cumulative burning of the tips. Wipe on both normally open and normally closed contacts prevents false operation under vibration. Arc-resistant melamine contact block has long life.

ATTRACTIVE, BUT PRACTICAL:

Color stays clean and bright because it's anodized in the ring, and around the button away from area of use. Color coding can be seen from the side as well as the front. Smooth, rounded contour blends with modern machine design. Standard or extra-large nameplates available for all forms.

EASILY INSTALLED:

Contact blocks, operators and color rings can be assembled with little effort. Wiring is simple. Large pan-head No. 8 screws with terminal clamps easily take No. 12 wire and cannot be twisted off when tightened. Screw will also take solderless-type lugs. Only normal hand tightening is required to make unit oiltight because of a special washer.

An entirely new concept of push-button design means greater flexibility, easier installation, and longer life of these units on your machines.

VARIETY OF FORMS AVAILABLE

Interchangeable rings are available in five colors—will fit both push-button and selector switch forms. No need to order complete units to get a special color. Operators are available with extra long button, mushroom head, locking attachment, cylinder lock, and in combination units in addition to the standard pushbutton and selector switch forms.

One basic form of contact block fits these operators; is attached by means of two screws. You save time and money in ordering or making up the forms you need.

COMPACT ENCLOSURES

In stations or enclosures these units are back mounted—simplifying wiring, and making a neat arrangement. Stations designed in accordance with JIC specifications are of strong, lightweight cast aluminum with a Buna-N gasket to keep out oil, water, and coolant.

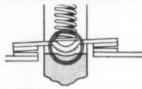
BUILDING BLOCK CONSTRUCTION:

The same basic contact block is used on all push-buttons and selector switches. Double-pole, double-throw combinations are made by mounting two blocks on the same base. Tandem combinations with four contact blocks are easily made up by using an adapter plate. Write for Bulletin GEA-5779. General Electric Company, Schenectady, N. Y.



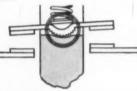
Inventory is reduced with these G-E units that have interchangeable color rings, separable operators, and one basic form of contact block.

G-E SELF-A-LINE CONTACTS



ON MAKE:

When stationary contacts are misaligned movable contacts align with them.



ON BREAK:

Contacts always break evenly regardless of any misalignment of stationary contacts.

Wear is distributed evenly over both contact surfaces. Result: a 2:1 increase in life—by actual load-life tests.

NEORMATION FOR





duty push-





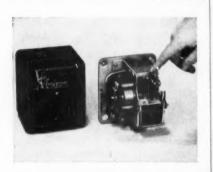






HEAVY-DUTY PUSH-BUTTON STATIONS ARE VIBRATION RESISTANT-LONG LIVED

Enclosed in a strong steel case, G-E heavy duty units have silver-tipped contacts with strong springs that stand up under constant vibration and use. Many combinations are possible with momentary and maintained-contact buttons, selector switches, and indicating lights. Terminals are large for easy wiring. Large buttons encircled by guard rings prevent accidental operation. Surface and flushmounted stations available. Bulletin GEA-5043 describes all forms.

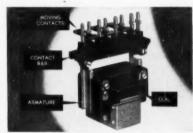


ACCURATE TIMING WITH THIS RELAY-STEPLESS ADJUSTMENT

For process timing this relay has a repeat accuracy of 0.5 per cent of maximum time setting. Four forms available for time ranges of 3 to 100 seconds up to 12 minutes to 623 hours. Synchronous motor driven. Switch has both an instantaneous and time open/time closed contact. For more information on this easily adjusted timing relay write for Bulletin GEC-600.

STRONGBOX COIL MEANS EXTRA LONG LIFE FOR G-E MAGNETIC MOTOR STARTERS

This unique plastic-encased coil resists moisture, dust, and oil-cannot be damaged by a slipping screwdriver during wiring and installation. Permafil* varnish, which does not liquefy in heat, prevents windings of Formex* magnet wire from abrasion under vibration and is sealed under vacuum so no "hôt spots" can develop.

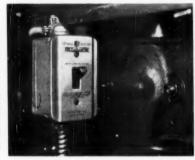


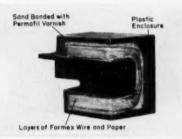
Coil acts as permanently lubricated guide to moving magnet. No metal-to-metal friction.

*Reg. trade-mark of General Electric Co.

FRACTIONAL-HP MOTOR STARTERS HAVE **EXTRA PROTECTION FEATURES**

Bi-metallic overload relays take a variety of heater sizes-tab in operating handle quickly identifies rating. On overload, handle moves to OFF for position indication. Protection to contacts and overload relay is provided by a plastic enclosure within the steel case. The outer case has four 16-inch and two combination knockouts for easy mounting. Write for Bulletin GEA-2234.





G-E Strongbox magnet coil has windings encased in molded plastic to prevent damage from vibration, moisture, dust, and screwdrivers.

The grooved sides of the plastic enclosure serve as guides to the moving magnet armature. A lubricant impregnated in the block reduces friction for fast, easy action at all times. There is no rubbing of metal against metal, so wear is reduced. Positive "make" and "break".



Wiring is easy. When the screw is backed off to make room for insertion of the wire, the clamps and lockwasher follow the screw head.

Coils are easily interchanged, come in ratings of 110, 220, 440, 550, and 600 volts. Simply remove four easy-to-reach screws, and the coil slips out over the stationary magnet. Design is simple, compact. Coil terminals are front-connected, clamp-type-solidly anchored in the plastic enclosure—will not twist loose when tightened on the wire.

Ask for the starter with the Strongbox coil-it's an exclusive feature of all G-E a-c full-voltage magnetic starters in NEMA Sizes 0 through 3 for one to 50 hp motors. Write for Bulletin GEC-880.

For more information contact your nearest G-E representative, agent, or distributor or write Section A730-43, General Electric Co., Schenectady 5, N. Y.

Day in--Day out DEPENDABILITY...

Year in--Year out ECONOMY...

WATERTITE LAZAPRENE CONTROL CABLES

Assurance of day in and day out maintenance-free performance makes Hazard Watertite-Hazaprene cable construction ideal for control circuits. From the inside out – from the corrosion-resistant Hazaloy coated conductors to the rugged Hazaprene sheath – Hazard Watertite-Hazaprene is engineered for long-lived economy.

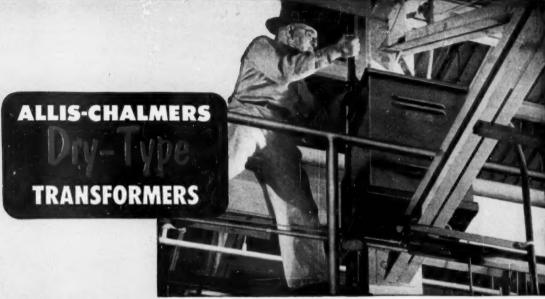
Watertite-Hazaprene amply meets the exacting requirements of control cable service. Rubber fillers prevent the wicking-in of moisture . . . firm, electrically strong, long-lived Watertite rubber insulation prevents deformation . . . the tire-tough Hazaprene ZBF sheath offers superior

resistance to flame, oil, acid, alkali, sunlight, moisture and mechanical damage. The ZBF sheath is a research-developed, service-tested protective covering, compounded of neoprene to Hazard's special Zinc Borate Formula; it is pressure-vulcanized in a continuous lead sheath to give a smooth, dense surface that resists abrasion and tearing.

There's a Watertite-Hazaprene Cable for every control circuit requirement. For further information about these dependable, money-saving control cables, write to Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.









They're Endurance Built

Core and coil assembly is impregnated to guard against moisture and dirt. All-welded, modern-looking case protects the internal assembly. Case is Spra-Bonderized to protect it against corrosion. Three coats of baked-on alkyd resinous paint furnish additional protection.

Ratings 167 kva and smaller (single phase); 300 kva and smaller (three phase), 600 volts and below.

He's Boosting Low Voltages!

How? By installing an Allis-Chalmers dry-type transformer close to the load it serves. This will result in higher motor, lighting and thermal efficiency and safe, economical utilization of power for plant equipment.

Mounted on overhead trusses, these dry-type transformers free valuable floor space for production purposes. They can also be mounted on walls or columns. Vaults or expensive enclosures are not required.

Speed Installation

Allis-Chalmers dry-type transformers are easy to connect because junction boxes are eliminated. For connecting the conduits directly to the transformer case, knockouts are provided. System cables are connected to the transformer terminals in roomy compartments.

Easy to Maintain

Install them and forget them except for periodic inspections. No insulating liquids to mess with; no gauges or gaskets to fuss with.

You can get more information about these Allis-Chalmers Class B insulated dry-type transformers from your Allis-Chalmers district office.

Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A.3829

ALLIS-CHALMERS





WIRE BY PHELPS DODGE MEANS WIRED FOR LIFE!

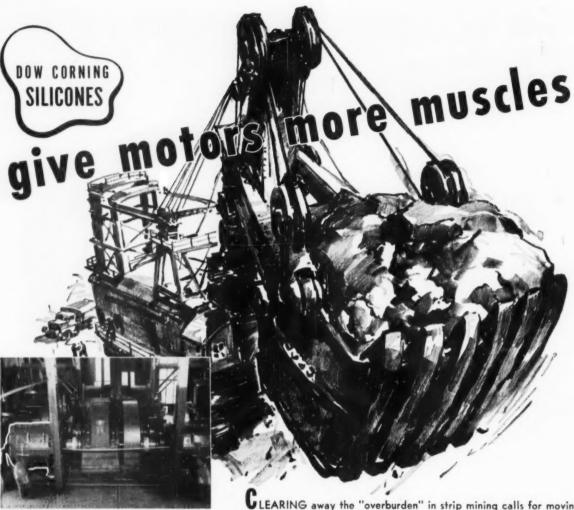
It Pays to Watch Quality—Tomorrow's Job

May Depend on the Cable You Installed Today!

Selecting Habirshaw cable—a product of the Phelps Dodge
Copper Products Corporation—is a sure way of guaranteeing your
own reputation for highest quality work. Habirshaw standards
of quality are reflected in top-grade materials, fine workmanship
and over-all excellence.

See Your Phelps Dodge Distributor!

PHELPS DODGE COPPER PRODUCTS



(Photo courtesy National Electric Coil Co.)

On the hoist motor outlined above Class B Insulation failed 18 times in less than 8 years. Rewound with Class H Insulation made with Dow Corning silicones, the motor is still in excellent operating condition after 4 years of uninterrupted service.

LOOK AT THE RECORD

DATE AND CAUSE OF FAILURE

2/21/40	7/28/45
Armature coils grounded	Armeture coils grounde
12/29/40	9/14/46
Armeture coils grounded	Armature coils grounde
9/2/41	2/6/47
Open armature circuit	Armature coils grounde
4/13/42	6/23/47
Armature coils grounded	Armature coils grounde
4/18/42	9/17/47
Leads loose in commutator	Armature coils grounde
10/24/42	11/4/47
Armeture bend thrown	Armsture band thrown
4/5/43	12/26/47
Armature coils grounded	Armeture coils grounde
8/9/43	1/7/48
Open armature circuit	Rewound with Class H
10/7/43	1949
Armature coils grounded	No failure
9/30/44	1950
Armature coils grounded	No failure
10/18/44	1951
Armeture coils grounded	No feilure

LEARING away the "overburden" in strip mining calls for moving a lot of dirt and digging into solid rock. Excessive overloads limited the service life of this main hoist motor to 5 months. Rewound with Dow Corning Silicone (Class H) insulation, the motor has already outlived its previous service record almost 10 times; has prevented at least 9 costly breakdowns at an estimated down-time rate of \$1000 per hour.

That kind of performance has been repeated in thousands of different installations. That's why more and more production men in varied industries are insisting upon Class H insulation for their hard working motors. These may be critically important motors; motors subject to frequent overloads; motors operating in high ambient temperatures or exposed to a combination of heat and damp or corrosive atmospheres.

Users of Dow Corning Silicone (Class H) insulation are finding that it pays for itself over and over again. In fact, life expectancy of Class H insulation made with Dow Corning silicones is in the range of 4 to 100 times the life of Class B insulated equipment under comparable operating conditions. And Class H costs little more than the second best class of insulation.

For complete information on Class H Insulation, list of rewind shops or sources of supply, call our nearest branch office or write Dept. G-1,

DOW CORNING CORPORATION

MIDLAND . MICHIGAN



Atlanta
Chicago
Cleveland
Dallas
Los Angeles
New York
Washington, D. C.

In Canada: Fiberglas Canada Ltd., Toronto

Great Britain: Midland Silicones Ltd., London

in Switchgear...

EXTRAS COUNT!

Specify ROLLER SMITH

Get all the extras

Roller-Smith switchgear provides . . .

extras in Safety, Accessibility and Economy of operation.

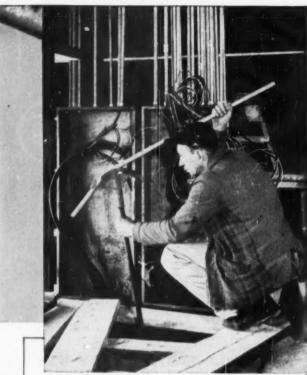
- SAFE All equipment is metal enclosed . . . weather proofed when required . . . built to NEMA and AIEE standards for safe, dependable performance. The "up-to-theminute" design of Roller-Smith switchgear assures extra safety for operators.
- ACCESSIBLE All sections of RS switch ear are easily accessible for quick inspection and adjustment. This cuts maintenance time to a minimum . . . makes it easier to do a thorough job.
- **ECONOMICAL** All Roller-Smith equipment is precision-built according to your specifications . . . tested before you get it. When you specify Roller-Smith, you can count on extra long, trouble-free operation with less "down time" for repairs.

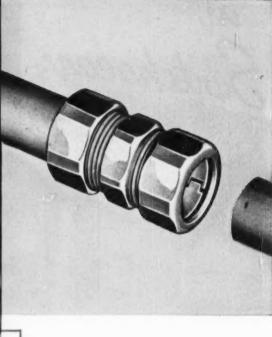
Consult your nearest Roller-Smith representative, or write to us for catalogs which fully illustrate and describe our complete line of low voltage draw-out; moderate duty, vertical lift Metal Clad; and heavy duty Metal Clad switchgear.

ROLLER-SMITH CORPORATION

Bethlehem, Pennsylvania

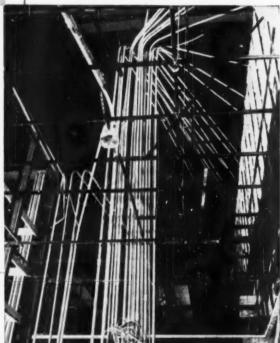
ROLLER





Fast accurate bends assure accurate installation of ELECTRUNITE E.M.T at the panel boxes.

Thousands of feet of ELECTRUNITE E.M.T. protect hundreds of circuits in this Federal Department Store, Cleveland, Ohio.



STEEL AND TUBES DIVISION

REPUBLIC STEEL CORPORATION

229 STEEL AND TUBES BUILDING . CLEVELAND 8, OHIO



Giant neighborhood department store... wired with ELECTRUNITE E.M.T.

Hundreds of circuits, service outlets, and controls in this Federal Department Store are wired through light-and-strong Steel ELECTRUNITE E.M.T. The dependability of electric service is greatly increased; dangers of outages due to moisture, fire, or impact are practically eliminated; the protection of steel assures wiring-life that's equal to building-life. Electricians like to work with ELECTRUNITE E.M.T. ... it's easy to cut, bend, and install in a professional and workmanlike way. Exclusive "Inch-Marked®" lengths assure accurate cuts and bends ... exclusive

inside knurling makes wire-pulling easier . . . easy-to-tighten connections permit moisture-tight joints without turning whole runs.

Contractors report fewer headaches on an ELECTRU-NITE E.M.T. job . . . schedules are easy to maintain; workmanlike installation is easier to make.

In some extra-corrosive locations, not even ELECTRU-NITE E.M.T. can stand the gaff of chemically-saturated moisture. Plastic-armored ELECTRUNITE "Dekoron-Coated" ELECTRUNITE E.M.T. is made specially to last longer in toughest locations. Write for literature.





G-E Hook-on Volt-ammeter Stays Accurate

STURDY DESIGN AND HEAVY-DUTY PARTS ASSURE DEPENDABILITY AND LONG LIFE

Shock-proof construction, built-in magnetic shielding (from fields of adjacent conductors), and temperature-compensated circuits are only three of the many features of this new G-E hook-on that help assure you of sustained accuracy. Strong dovetail joint in the transformer makes errors caused by imperfect closing practically negligible. The convenient and reliable range-selector switch provides positive range switching—enables you to make current or voltage readings quickly and simply.

OTHER NEW FEATURES

A new, easily adjusted pointer-stop mechanism simplifies reading motor-starting currents. In addition, this versatile hook-on has five current scales ranging from 7.5 to 750 amperes; three voltage ranges are 0-150/300/750 volts. Accuracy for all readings is 3%—even on low current ranges.

ONE-HAND OPERATION

Current is measured by simply hooking the jaws of the instrument around the line. Voltage readings can be made by attaching the extra large alligator clips across the line. A flick of the selector switch gives you the desired full scale; and current readings can be taken without removing the potential leads.

NOW AVAILABLE

See this newest member of the G-E hook-on family today at your nearest G-E apparatus distributor. No increase in price over the previous model: \$66.75*. General Electric Company, Section 602-246, Schenectady 5, N. Y. *Manufacturer's suggested retail price.





ADDED RANGES: New higher and lower current ranges (0-7.5/30/75/300/750 amperes) and higher voltage range (0-150/300/750 volts) can be quickly selected with the handy selector switch.



NEW POINTER STOP makes reading of motor-starting currents easy. Using one finger, set stop until pointer barely deflects: the scale reading will then indicate motor-starting current.

Complete Control and Protection for Your Motors

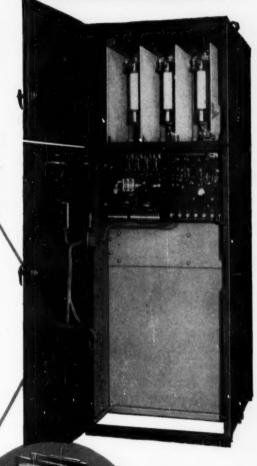
ONE ATTRACTIVE easy-to-install steel cabinet is all you need between line and motor when you specify Allis-Chalmers Type H Starters. Contactors, protective devices, meters, relays . . . everything you need for complete control and protection of your motors is built into Type H Starters. You get:

- 1 Short Circuit Protection . . . provided by current limiting fuses that are easily accessible.
- 2 Overload Protection . . . Thermal relays have compensating elements automatically adjust for ambient temperatures trip on motor overload only.
- 3 Safe, Accessible Cubicle . . . upper front compartment encloses disconnect type fuses; lower front compartment, the low voltage control devices; rear compartment, the high voltage equipment.
- Easy Installation . . . single steel enclosure is easy to handle, internal wiring is complete, wiring terminals accessible, easy to connect.
- 5 Personnel Protection . . . high voltage fuse compartment has electrical interlock.
- Meters, Push Buttons, Recording Instruments, Rheostats, and similar devices you may need are mounted on the door of the low voltage comportment.

Other features include undervoltage protection . . . and your choice of either air break or oil immersed contactors — whichever is best for your application.

For motor control that is engineered to your job, specify Allis-Chalmers Type H Starters for motors with ratings up to 2500 hp. Call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin for bulletin 14B6410A.

Type H Starters



Specify Type 256 Air Break Contactor, shown, for tough, repetitive duty, longer contact life . . . Type MO Oil Immersed Contactor for normal starting duty or for service in dust laden, corrosive or very moist atmospheres.

A-3350

ALLIS-CHALMERS



no description needed



those who use General switches know WHY-

they are without equal!



WRITE FOR CATALOG #5201

ENCLOSED SAFETY SWITCHES · BRANCH CIRCUIT PANELS · SERVICE ENTRANCE EQUIPMENT

Need coated insulation?



... or insulating varnishes?



FOR EVERY REWIND JOB... there's a quality Irvington Insulation

For motor rewinds that really stand up, look into the comprehensive Irvington line of coated insulations and insulating varnishes.

OUTSTANDING IRVINGTON PRODUCTS INCLUDE:

Class "H" Insulations. Silicone Resin-impregnated Fiberglas*. Silicone Rubber-coated Fiberglas. Silicone Rubber-coated Fiberglas Tubing. Silicone Resin-coated Asbestos. Silicone Resin-saturated Asbestos. Teffon**-coated Fiberglas. Silastic*** Tape.

Class "B" Insulations. Varnished Fiberglas. Varnished Asbestos.

Class "A" Insulations. Varnished Cambric, paper, nylon, Orlon, silk, rayon. Irv-O-Slot slot insulation.

Insulating Varnishes — baking and air drying types. Oilproofing enamels.

Plastic Tubing, Tapes and Wire Markers.

*® Owens-Corning Fiberglas Corp. **® Du Pont ***® Dow-Corning

Ask for literature on any of these groups of Irvington time-tested products.

IRVINGTON

for Insulation Loadership
INSULATING VARNISHES
VARNISHED CAMBRIC
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INSULATING TURING
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Plants: Irvington, N. J.; Monrovia, Calif.; Hamilton, Ontario, Canada

Irvington Varnish & Insulator Company 18 Argyle Terrace, Irvington 11, New Jersey EC-1/53

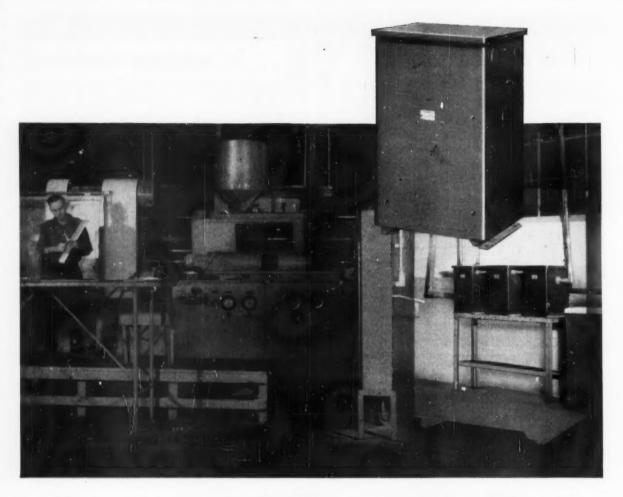
Gentlemen

Please send me technical literature on the following Irvington products

Name.....

Company....

Address....Zone....State.....



There's money hidden in this picture!

Yes, there's money hidden in this picture, lots of it! It's the money a plastics manufacturer saved by installing three Westinghouse Dry-Type Transformers on each of his presses.

You can see it... in the economical mounting ... in the short run of secondary leads to the molding press. It's there... in the savings these transformers offer by improving voltage regulation and simplifying maintenance.

The Eric Resistor Corporation, Eric, Penna., installed Westinghouse Dry-Type Transformers on all their injection molding presses. They utilized existing bus ducts, paid minimum installation costs to step voltage down to the required

220 volts. Like Erie, you can meet the demands of changing electrical loads quickly, most economically with Westinghouse Dry-Type Transformers. Available with or without circuit breakers built in.

Get a more complete story from your local Westinghouse representative. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, Pennsylvania.

J-70641

DRY-TYPE
TRANSFORMERS

FOR OFFSET NIPPLES, NO-THREAD FITTINGS, CONDUIT BODIES ...

GEDNEY ALWAYS!

YOU CAN ALWAYS rely on Gedney Fittings to cut *installed costs* and save real money. For Gedney Fittings are always accurately machined and threaded . . . smooth finished, with no burrs or metal particles . . . quick and easy to install . . . made of unbreakable malleable iron. . . . For best profits, order Gedney Fittings, always!

TYPICAL OF THE FULL GEDNEY LINE OF MALLEABLE IRON FITTINGS ARE:



Offset Nipples in sizes from ½" to 2", with ¾" offset. Cadmium plated.



A wide choice of No-Thread 90° Elbows for rigid conduit, and of No-Thread Couplings and Connectors for Sealtite* conduit — all cadmium plated.

*Trade Mark - The American Metal Hose Branch of The American Brass Co.

Conduit Bodies in a full range of types and sizes for heavy wall rigid conduit—hot dip galvanized.

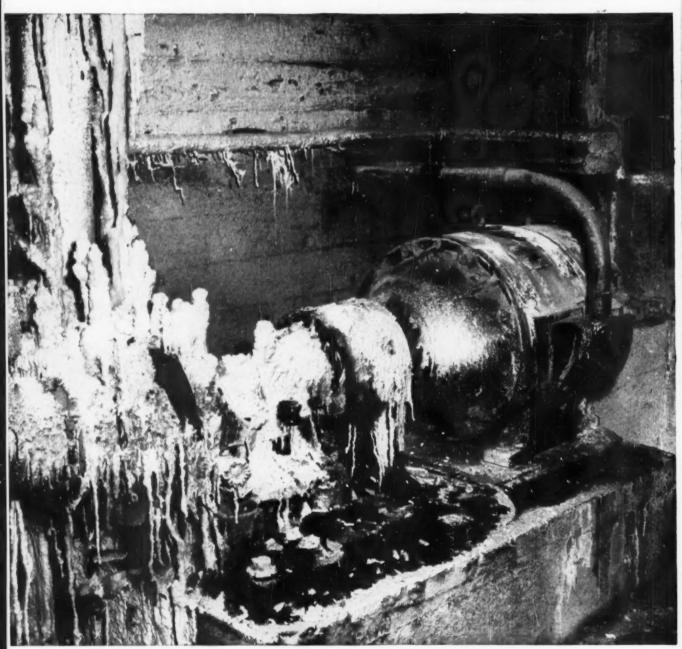


GEDNEY



RKO BLDG. • RADIO CITY • NEW YORK 28
Foundry, Factory and Shipping Point: Terryville, Conn

WHEN JOBS ARE TOUGH



CORROSIVE ATMOSPHERE doesn't bother this standard, "off-the-shelf" Tri-Clad motor. Totally enclosed,

fan cooled, it runs 12 hours a day, six days a week, driving a flash cooler pump under tough conditions in a chemical plant.

GENERAL



ELECTRIC

INDUSTRY DEPENDS ON G-E TRI CLAD MOTORS

Here are three typical tough jobs being done safely, economically, and without interruption, by G-E Tri-Clad motors. They help show why more than 10,000,000 horsepower of G-E Tri-Clad motors are serving American industry today.

WIDEST VARIETY

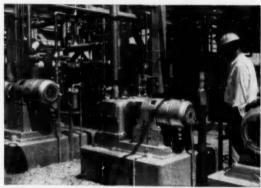
With the widest selection of standard motors obtainable anywhere, the Tri-Clad motor line offers ratings up to 2000 hp; all types of enclosures; gear motors, brake motors, and adjustable-speed drives—plus many other mechanical and electrical modifications to meet your requirements.

TRIPLE PROTECTION

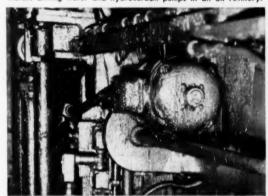
You get triple protection with every Tri-Clad motor—against physical damage, electrical breakdown, and operating wear and tear. Completely enclosed bearings last longer because they can be relubricated if necessary—and without shutdown! For specific product information, use the coupon below, or contact your nearby G-E Apparatus Sales Office, authorized G-E Agent or Distributor.

IMMEDIATE DELIVERY

Most standard G-E Tri-Clad motors are available immediately from stock. And the most complete sales and service network in the motor industry assures you prompt service by trained specialist and application engineers, for all your motor problems. General Electric Co., Schenectady 5, New York.



EXPLOSIVE ATMOSPHERE dangers are avoided by using standard explosion-proof Tri-Clad motors, such as these gearmotors driving water and hydrocarbon pumps in an oil refinery.



OIL, MOISTURE, ABRASIVE DUST can't stop this totally-enclosed Tri-Clad motor, operating below the strip in a cold strip steel mill. Motor is completely protected inside and out.

PROGRESSIVE MECHANIZATION a new G-E MORE POWER TO AMERICA program—motion picture and manual—case histories of the latest mechanization trends.	Section Q 752-16. General Electric Co., Schenectady 5, N. Y. Please send me the following on Progressive Mechanization: Free copy of the Progressive Mechanization Manual (GEA-5789)
Progressive Send for literature.	Please send the following product bulletins: GEA-3580 (Open Dripproof Motors) GEA-4400 (Totally Enclosed Motors)
Nume	
Firm Address City	Zone State



For many years Contractors from Coast to Coast have used Briegel All Steel Indenter Fittings. U. L. approved as concretetight and for general use, B-M Indenter Fittings are faster, easier to use and neater in appearance.



Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!



BRIEGEL METHOD TOOL CO.

Distributed by

The M. B. Austin Co., Northbrook, III.; Clayton Merk & Co., Evansten, III.; Nikoh Tube Co., 5000 South Whipple St., Chicago, III.; Clifton Conduit Co., Jersey City, N. J.;
The Steelduct Co., Youngstown, Ohio; Columbia Cable & Electric Corp., 255 Chestnut St., Brooklyn, N. Y.; Pittsburgh Standard Conduit Co., Pittsburgh,
Penn.; Wagner Malleable Products Co., Decatur, III.; J. R. Richards Co., Carnegie, Penn.; Kandu Mfg. Co., Ltd., Preston, Ont.

IF IT'S PARANITE IT'S RIGHT, Wire and Cable

PARAFLEX Non-Metallic Sheathed Cable lays flat. Wote't squirm or twist. Clean to handle. Plainly marked.

PARASYN Type TW Thermoplastic Wire stands exposure too severe for rubber insulated wires. Smaller diameter.

PARA-USE Type "RR" Cable provides permanent underground installation from power line to meter, and for connecting several buildings. Meets requirements of CAA Specifications L-824 as Type A (on all applicable sizes).

HYDRO-THERM Building Wire combines in a single wire the heat-resistant qualities of Type RH and the moisture resistant qualities of Type RW.

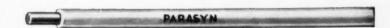
URC Weatherproof Wire and Cable can be relied upon to meet severe climatic conditions. Both actual line and Weather-Ometer tests prove unusual ageing characteristics.

SERVICE ENTRANCE CABLE,

Type SE Style U unarmoured and Type SE Style A armoured. There is also a Paranite Service Drop Cable, two conductor, Type SD.

DREADNAUGHT Heavy Duty Cable has lead-cured neoprone injulation. Flexible, durable, safe, long-lived. Cuts repairs and replacements. Delivers current continuously.















IF IT'S PARANITE IT'S RIGHT!

DISTRIBUTED THROUGH WHOLESALERS PARANITE WIRE AND CABLE
Division of ESSEX WIRE CORPORATION
FORT WAYNE 6, INDIANA

WIRES AND CARLES SINCE 1890

WARSHOUSES' AND SASS OFFICES: "Alleste, On, "Borley, Mens, "Chicago, R., Covering, Dille, Entry Toront, Mary, Indianopolis, Ind., Ticones City, May

EXPORT SALES OFFICE—LIONEL-ESSEX INTERNATIONAL CORPORATION, 13 E. 26th St., NEW YORK 10, N.Y.

ELECTRICAL WIRES AND CABLES "BETTER THAN CODE REQUIRES"

EMPLOYEES SAY,



Better than daylight"

with Westinghouse MERCURY lighting

"We get over 50 footcandles evenly distributed in this work area—and have completely eliminated the need for auxiliary lighting," says Chief Electrician of an Ohio plant about their new main high-bay-assembly area.

What's more, he further states that the employees report, "It's even better than working in daylight . . . there are no shadows or glare." A Westinghouse combination mercury-incandescent system takes credit for these results.

He concluded, "We have always believed that high-quality illumination pays for itself in more and better work, fewer errors . . . and this installation, made according to a plan, proves that it does just that." Only Westinghouse can offer you the complete mercury system—luminaires, lamps, and ballasts.

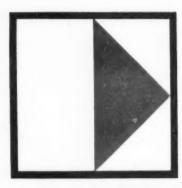
It will be well worth your while to investigate Westinghouse, where you can review all sources and all types before selecting one system. Get B-4727, "Lighting at Work" in every industrial area. Call your nearest Westinghouse Office or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-04298

YOU CAN BE SURE...IF ITS
Westinghouse



LIGHTING DIVISION





as fundamental as electric outlets





No electrical contract is complete unless it contains provision for telephone raceways. Electric outlets — enough of them in the right places — are important considerations when you're wiring a new house.

So are telephone outlets.

Selling the owner on concealed telephone wiring is one way to boost your profit on a job. It's a good way, too, for it means that the owner can have telephones where he wants them and that wires will be kept in the walls where they belong.

You'll find it's good for the owners and good for business when you add "built-in telephone facilities" to your new house contracts.



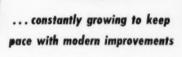




314" x 814" x 4"



4 3/16" x 4 3/16"



From the small "GRR" to the large "GRJ", the steady growth in the Killark family of explosion-proof junction boxes makes it possible for you to find the sizes and styles best suited to your specific requirements.

Each newcomer is visible testimony to Killark's endless pioneering in a field that requires constant touch with the latest in metallurgical research and functional designing.

And, of course, every Killark offspring bears a strong family resemblance: the gleaming-bright smooth cast surface, the clear-through Alumalloy construction that's light in weight, strong in service, safe and nonsparking, always rust and corrosion-proof.



SERIES "GES"

CTRIC MANUFACTURING COMPANY

Vandeventer and Easton Aves.

St. Louis 13, Missouri

SALES OFFICES AND WAREHOUSE STOCKS

ATLANTA 69 Mills Street, N.W.
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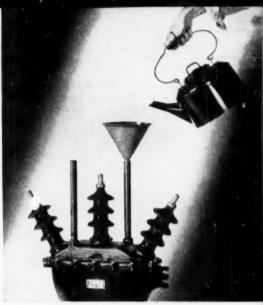
4130

924 Andrus Bidg.
30 Irving Place
50 26th Street
140 Spear Street
First Avenue South





A neater and better job can be obtained by using an AnacondA Jointing Kit. These unit packages of jointing materials contain all necessary materials to make one complete joint on a specific size and type of cable. An AnacondA Jointing Kit eliminates the possibility of inadequate materials...cuts down the need for large stocks.



Greater stability of AnacondA Insulating Compounds is based on extensive research for balanced compositions with proper physical and electrical characteristics for any installation.

ANACONDA CABLE ACCESSORIES

Service is better than ever on this complete line, designed by power-cable specialists for use with any make of cable. Expanded facilities keep pace with trend toward ordering cable and cable accessories together.

Anaconda's 20-year-old Cable Accessories Department is busier now than ever. In new and expanded quarters it is turning out greatly increased quantities of potheads, jointing kits, insulating compounds and paints. Back of this activity lies a story of increased demand by utilities, railroads, industrials, and equipment manufacturers for cable accessories that are engineered by power-cable specialists. Here, old and new customers have found the consistent quality, good engineering, ease of installation and low cost of maintenance traditional with Anaconda for years.

ANACONDA Potheads spearhead the line. Available in such types as capnut, switchgear, transformer, disconnect, and through types, they feature an interchangeability of parts equalled nowhere else.

More than 2000 different pothead assemblies can be furnished from standard parts for any particular conductor size and voltage rating in the multi-conductor caput type alone! Another popular item is the Anaconda Unit Package of Jointing Material. In one package (see illustration) is everything needed to make a complete joint on a specific size and type of cable. The kit saves time, simplifies ordering, minimizes the need for storeroom stocks, and helps assure installation of a joint engineered for the particular application.

To keep pace with the increasing demand for ANACONDA Accessories, it has been necessary again to greatly increase the facilities of the Cable Accessories Department. This Department is now in a position to promise prompt shipment on most of your orders. Call your Anaconda Representative. He is always ready to help you with your cable and accessories problems.

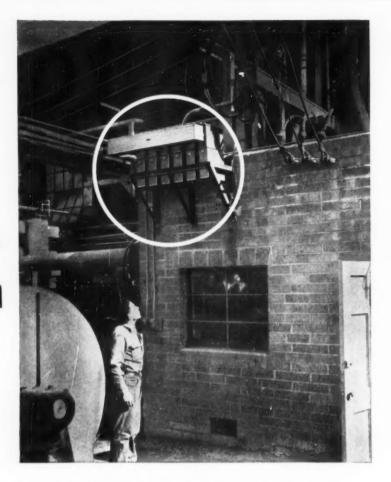
Accessories for all types and sizes of bare and insulated conductors.

ANACONDA

Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.		
Gentlemen: I'm interested in Anacond A Cable Accessories.	NAME	
Have your representa- tive call.	COMPANY	
Send me your 100-page Pothead and Terminal Catalog.	TITLE	
Send me your Jointing Material Catalog.	ADDRESS	
Send me complete Cable Accessories Catalog.	CITYSTATE	

Prevents transformer "burnouts." This 90-kvar, 3-phase, 60-cycle, 460-volt G-E capacitor equipment (circled) helps relieve transformer overloading. Solomon Fingold, Montrose Chemical's electrician, surveys it appreciatively.

Overloaded transformers relieved with G-E Capacitors



Montrose Chemical Corp. of Calif. prevents transformer "burnouts," saves \$1800 a year on power costs . . . with \$1451 investment.

Rapid postwar expansion put a heavy overload on the transformers that supply power to the Montrose Chemical Corp. of California, located in Los Angeles. Recently, when the overload became critical, the Company sought help. An investigation showed that the plant's power factor was down to 76%—so General Electric engineers recommended the installation of 180 kvar of General Electric capacitors at a cost of \$1451.

Capacitors improve power factor. Once installed, the capacitors brought the plant's power factor up to better than 97%. This relieved transformer overloading by reducing line current. And since Montrose Chemical had a power-factor clause in its power contract, it also cut power costs by \$1800 a year. Thus, the saving on power costs alone will pay for the equipment in less than ten months! And these savings will go on indefinitely.

Capacitors provide other benefits, too! Besides releasing transformer capacity, capacitors often permit your present distribution system to carry 20 to 30% more load without added equipment. Where voltage drop is a problem, capacitors can also provide the needed voltage boost inexpensively.

They often hold key to lower power costs. If your power factor is below 85% and if there is a power-factor or kva-demand clause in your power contract, chances are you, too, can make worthwhile savings on your power costs by installing capacitors. For additional information, consult your local G-E Apparatus Sales Office or authorized G-E agent or distributor. Or write to Section 407-210 for Booklet GEA-5632—"How to Use Capacitors to Reduce Power Costs and Gain System Capacity." General Electric Company, Schenectady 5, N. Y.

GENERAL E ELECTRIC

When Installing Conduit...

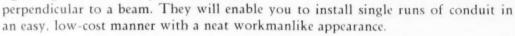
You can do a

Better Job Quicker

WITH . . .

STEEL CITY-KINDORF CLAMPS and HANGERS

With these clamps and hangers you can suspend single runs of conduit from beams, channels and angles of structural steel as well as from wood beams and ceiling. The strong steel clamps enable you to install conduit at right angles to a beam, parallel to a beam or



All items needed in hanging or supporting single runs of conduit are pictured and described in Catalog B-3, which will be mailed upon request.



. . . regardless of how complex the installation may be, you will find the needed

hangers and supports listed—complete with illustrations and application data — in Catalog K-11, which will also be mailed upon request.

STEEL CITY-KINDORF Conduit Clamps and Hangers like

STEEL CITY BOXES AND FITTINGS

A Quality Line That Saves You Time



STEEL CITY

OUTLET BOXES AND COVERS
SWITCH AND FLOOR BOXES
JUNCTION BOXES, CONDUIT FITTINGS AND KINDORF DEVICES

PITTSBURGH 33, PA.

aco

E. M. T. SAVE HOURS OF INSTALLATION TIME ... GIVE LASTING GRIP



These new EFCOR Set Screw Connectors and Couplings make possible amazing labor and material cost savings in non water-tight installations. One turn of set screw locks the E.M.T. firmly into place.

NO SPECIAL TOOLS NEEDED
—Installations which are inaccessible with an open end wrench are now quickly, easily accessible with an ordinary screwdriver!





STRIPPING OF SCREW
THREADS IS ELIMINATED—
Overlapping of steel in the construction of the body doubles the length of the screw thread.



SET SCREW COUPLING

DENOTES BINDING SURFACE

EFCOR CASE HARDENED CUP SCREWS LOCK TUBING MORE SECURELY THAN CONVENTIONAL POINTED SCREWS BECAUSE THEY BIND A GREATER SURFACE AREA OF TUBING.

FOR WATERTIGHT INSTALLATIONS USE EFCOR COMPRESSION TYPE E. M. T. FITTINGS



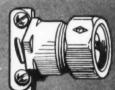
750-755



760-765



770-772



274 %" Greenfold to ½" E.M.T.

Floors.

wide and complete line of electrical fittings for all installations is available to you from warehouses situated in all principal cities.

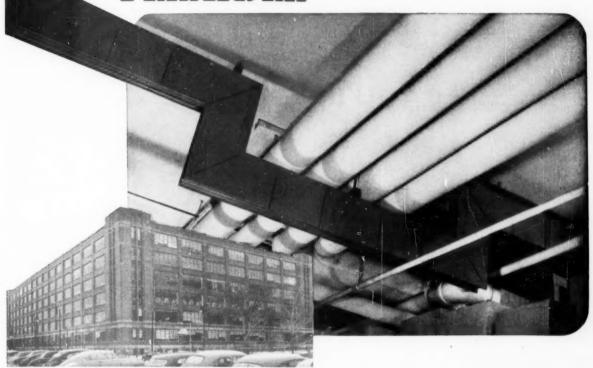
FOR FREE ILLUSTRATED CATALOG AND PRICE LIST write to



ELECTRICAL FITTINGS CORP., DEPT. C1 WOODSIDE 77, NEW YORK

SOLD THROUGH WHOLESALERS ONLY

BUS DUCT IS FLEXIBLE



Parke, Davis & Company plant modernizes with Westinghouse Bus Duct

"Neat... clean ... flexible!", say Parke, Davis & Company engineers about the installation. The contractor reports, "My men liked installing Westinghouse Bus Duct... and the ease of mounting it around pipes, through walls and across wide open spaces saved us considerable time and money."

This vast installation of standardized Low Impedance and Plug-In Bus Duct has recently been completed at the Parke, Davis & Company, Detroit, Michigan, where a complete changeover was made from a d-c to an a-c system.

This duct has greater current-carrying capacity pound for pound than any other means of secondary power distribution. Plug-In Duct has outlets every foot to allow for rapid machine tie-ins. Duct sections are fully salvageable and can be expanded or relocated with little effort.

Four types of Westinghouse Bus Duct are available to meet any load condition and service requirement. Call your Westinghouse Representative for complete details or write for B-4272-A. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

Westinghouse



BUS DUCT

HOW CAN A Friendly MANUFACTURER HELP YOU IN YOUR BUSINESS?



We at Triangle have an old fashioned idea that what we and our distributors can give you—friendship, help, cooperation, is sometimes more important than the wire, cable or conduit we sell you.

That feeling is strengthened every time we get a letter saying, "You and your distributors sure helped us out of a jam" or "We can't help but tell you how much we appreciate your cooperation."

When you constantly get such comments, you know that a lot of people like you are profiting from doing business with Triangle. Perhaps you too will find that things run smoother when you do business with Triangle.

Here are some of the things our field men, in cooperation with a nation-wide network of top electrical distributors, give, every working day—and many a night!

- Expert, friendly counsel on how to get the most and best wire, cable and conduit for your money.
- Expert engineering assistance at any point of the job—and for as long after as you choose.
- An expediting service famed for its helpfulness. We're not supermen, but if it can be done, we'll do it.
- Printed material -calculators, wiring manuals and other literature useful to you many times during the year.
- A spirit of friendliness and helpfulness that will make you feel comfortable when dealing with Triangle.

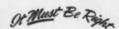
No matter who you are - contractor, engineer, maintenance man - no matter who you work for utility, city, contracting firm, large industrial -

YOU'LL LIKE DOING BUSINESS WITH TRIANGLE!

TRIANGLE

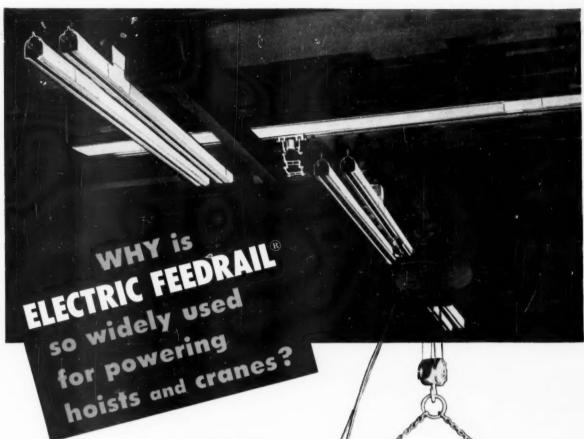
TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY



The Trade Mark

WHEN IT'S A QUESTION OF CARRYING ELECTRICAL POWER, CALL FOR TRIANGLE



The basic reason is clear-cut. ELECTRIC FEEDRAIL, with its enclosed conductors, eliminates the hazards of exposed wiring and reduces maintenance. In other words, from the power standpoint, ELECTRIC FEEDRAIL makes hoist and crane operation as near 100% safe as it can be for both personnel and equipment. It's trouble-free and a real money saver.

Write for descriptive literature which gives you full details about ELECTRIC FEEDRAIL, including facts and data on capacities, installation, planning and the preparation of specifications.

52-3 Rev.

The ELECTRIC FEEDRAIL system, with its standard straight, curved and transfer track sections, is readily "tailored to fit" practically any crane and hoist installation. It's the safe, convenient, adaptable system for both new and existing installations. Full engineering cooperation is at your service—without obligation.

Sold by leading electrical distributors

ELECTRIC FEEDRAIL®

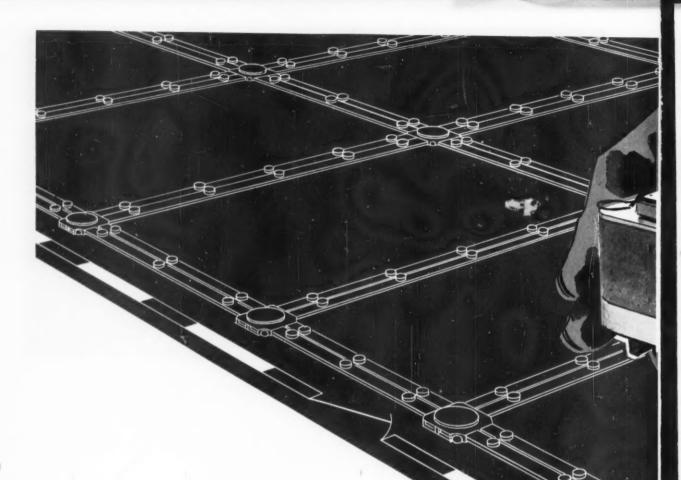
FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

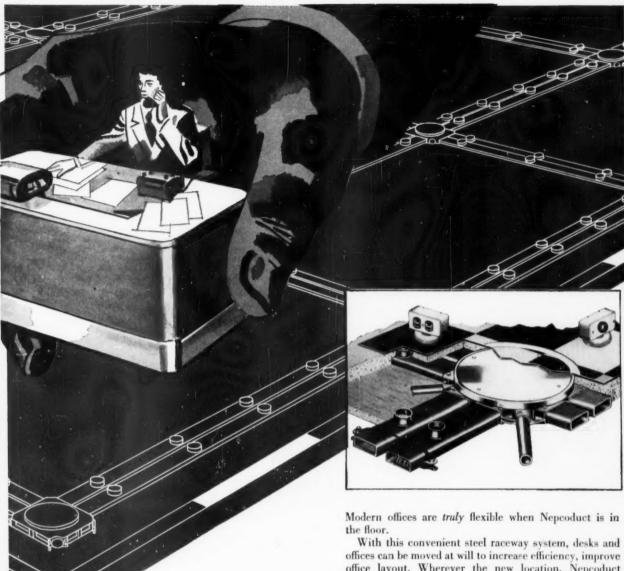
125 BARCLAY STREET . NEW YORK 7, N. Y.

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

Lever Becomes Obsolete



Move John anywhere...



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telephone and electric light and power outlets are everywhere!

office layout. Wherever the new location, Nepcoduct brings light, power, communication, signal and telephone circuits to the floor surface. No need to cut into building structure for every move.

Tenants like Nepcoduct because outlets can be located easily, quickly, with no interruption of office routine. Building owners like the economical maintenance it allows. Architects and builders like its adaptability to any type of building, any type floor construction.

Nepcoduct is the standard underfloor wiring systemsteel for permanence, grounded for safety.

For life-long flexible wiring, be sure that Nepcoduct is in your plans-for new construction or modernization. Write today for the Nepcoduct catalog.

EVERYTHING IN WIRING POINTS TO

National Electric Products



Coupling Conduit ? it's easy... with an O.Z. Split Coupling

UL Approved

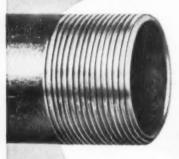


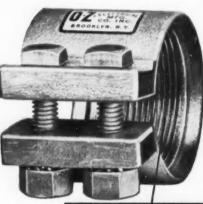
THESE YOUR PROBLEMS?

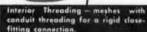
Not enough space
No room for wrench
Hard to get at
Conduits can't be turned



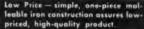
O. Z. is the simple, dependable way to couple conduit. Just butt the conduit ends within the opened O. Z. Split Coupling, tighten two nuts and you have a permanent joint.

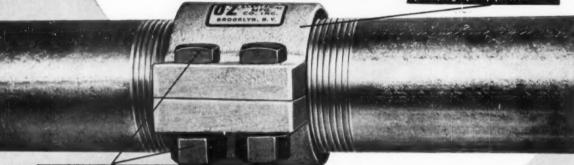












Low Installation Cast — simply slip over conduit ends and tighten nots to close fitting. Bolt head is held in place by coupling shoulder.

Available for conduit sizes ranging

MANUFACTURING
COMPANY, INC.

Your local O. Z. distributor is ready now to serve you from stock.

Get in touch with him for further information on the complete,
dependable O. Z. line of electrical fittings.

CONDUIT FITTINGS . CABLE TERMINATORS . GROUNDING DEVICES CAST IRON BOXES . SOLDERLESS CONNECTORS . POWER CONNECTORS

LINES OF SAFETY SWITCHES LOCAL MARKETS



GENERAL PURPOSE

90,000 line designed for residential, commercial and other applications where price is limiting and the service factor is not great.



UNIFORM STYLING

one line can't do two or three jobs without compromising price and performance!



INDUSTRIAL

40,000 line designed for general industrial or institutional and commercial applications where the service factor is greater and price is an important consideration.

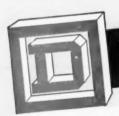
MEETS BOTH GOVERNMENT AND NEMA SPECIFICATIONS FOR TYPE A SWITCHES.



HEAVY-DUTY INDUSTRIAL

80,000 and 50,000 line designed for mass production industries where price is secondary to continued performance under conditions of severe service and maximum safety. The 50,000 line is used where space is limited. BOTH ARE TYPE A but go far beyond those requirements.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS



SQUARE D COMPANY

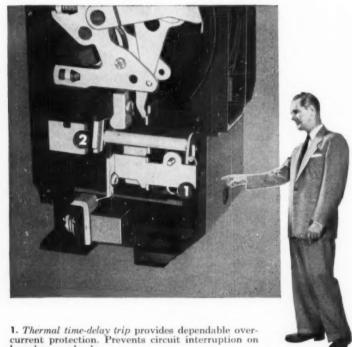
Why modern plants

HREE REASONS

need modern I-T-E circuit breaker protection

Vital power arteries doubly protected

When you install modern, industrialtype I-T-E Circuit Breakers on vital power, lighting, and distribution circuits, you get positive 2-way protection. You get protection against both short circuits and overcurrents. Breakers are pretested and calibrated to trip at precise, known limits.



harmless overloads.

2. Magnetic instantaneous trip assures split-second tripping on short circuits.

Service restored . . . in seconds

If an I-T-E breaker trips on a fault, service is restored *in seconds*. Merely resetting the operating handle permits production to continue. There's no waiting, no excessive downtime. And remember—if a breaker trips *just once*, it may pay for itself in the production time it saves!



I-T-E 100-ampere "F" frame circuit breaker in Nema Type 1-A sheet steel enclosure.

First cost the last

Once you've installed an I-T-E Circuit Breaker, there's no continuing expense—each time there's an interruption. I-T-E breakers are compact and self-contained. They are built to last indefinitely. There's no deterioration, no fussing with replacement parts. And a breaker provides maximum safety.

I-T-E Molded Case Circuit Breakers come in four frame sizes, 4 enclosures. Available in ratings from 10 to 600 amperes, up to 600 volts a-c, up to 250 volts d-c. For details about the complete I-T-E line, send for a copy of Bulletin 5108-D or contact your nearest I-T-E representative.



breaker quickly.

to restore service. Anyone can

MOLDED CASE CIRCUIT BREAKERS

I-T-E CIRCUIT BREAKER COMPANY . 19TH AND HAMILTON STREETS . PHILADELPHIA 30, PA.

Reduce Downtime Reduce Downtime ofter circuit faults

USE AB-I CIRCUIT BREAKERS

Figure it this way. When a Westinghouse AB-I Circuit Breaker trips . . . anyone can "Reset" it in seconds after the fault is cleared. Simply turn the handle to "Reset" and back to "On". Production down time is minimized.

Compare this with outages on other types of circuit-protective devices. Men and machines stand idle, waiting for an element replacement. You lose valuable production time.

Think it over. You consume expensive time replacing elements. Multiply your total outages by this down time. Can you afford the waste?

AB-I Breakers require no replacement parts, eliminate the repetitive use of critical materials.

Other exclusive AB-I features include unequaled "De-ion®" Arc Quenching, quick-make, quick-break mechanism, low wattage loss and ability to carry temporary nondangerous peak overloads without tripping.

Find out why AB-I Circuit Breakers pay. Call your Westinghouse Distributor or write for B-5456, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J.30092



Westinghouse

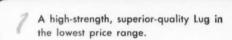
AB-I Greuit Breakers

W

"Of course, circuit breakers save money."

BLACKBURN TERMINAL LUGS

40UR BEST 40EASONS



- Made all in one piece no joined parts to break loose.
- Small and compact—will fit in small gutters and other very close quarters.
- 6 sizes as illustrated cover a complete wire range from No. 14 to 1,000,000 CM.
- Only 3 socket wrenches cover 4 sizes, and a screw driver tightens the 2 smaller lugs. Also available with hex head bolt instead of socket set screws.

Jasper Blackburn Corporation

35 MADISON ST.

ST. LOUIS 6, MO.

Phone CEntral 3007

Mail Coupon for Sample and Full Details

Send me sample and further information on BLACKBURN HI-Strength Terminal Lugs:

Mail to Jasper Blackburn Corporation • 35 Madison St. • St. Louis 6, Mo.

Wire Size

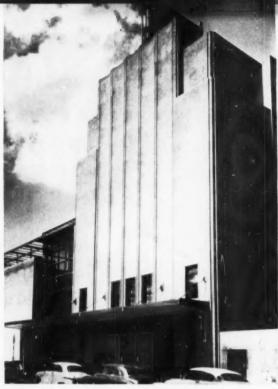
Your Name

Company

ECM



TELEVISION POWER BREAKER. The 500-kva G-E unit substations at WWJ-TV have voltage ratings of 4800-208Y/120, are equipped with Type AK-1-25 air circuit breakers.



WWJ's NEW BUILDING houses studios of Detroit's pioneer TV station. General Electric load-center system furnishes power for amplifying, lighting—other station requirements.

Detroit's new TV studios rely on

Power continuity assured for all studio requirements at WWJ-TV by secondary-selective distribution system

For the engineers of WWJ-TV—Detroit's pioneer TV station and an affiliate of WWJ, the world's first commercial radio station—a dependable source of continuous power rates first consideration in planning the new television studios. Total or even partial power shutdown cannot be tolerated.

At its new studios, WWJ-TV needs reliable power for lighting and amplifying... for its monitor panels and relaying equipment... for all station auxiliaries such as fans and blowers. To assure reliable power continuity for these many exacting requirements, Giffels & Vallet, Inc., L. Rossetti, associated engineers and architects, and Jack A. Frost, electrical contractor, installed a G-E secondary-selective load-center system consisting of two 500-kva unit substations.

With this distribution system, the station gains, too, in savings basic to load-center power. For example, a G-E engineered load-center system maintains consistent voltage for top operating efficiency, keeps

voltage drop down to a minimum, provides less costly feeder breakers, and reduces cable costs.

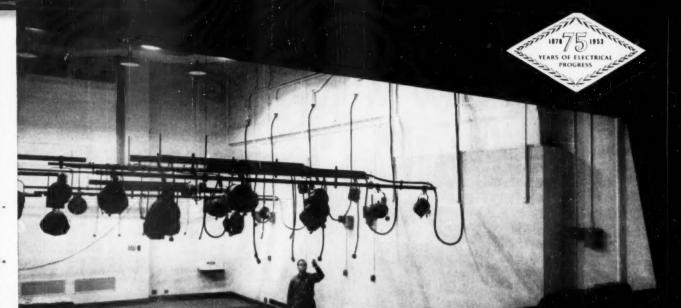
Air circuit breakers, with ratings properly coordinated with transformer capacities, give adequate interrupting capacity and isolate troubles in feeders. Oil fuse cutouts are interlocked to prevent opening with load on transformers.

Flexible layout permits easy, quick maintenance without interruption of power. System flexibility itself provides for addition of new loads, making it far less costly for the station to expand in the future. Grounded, metal-enclosed G-E load-center units, with non-inflammable Pyranol* transformers assure maximum protection for operating personnel.

For further information on G-E engineered load centers, call your local G-E sales representative, or write for GEA-3592, General Electric Company, Schenectady 5, N. Y.

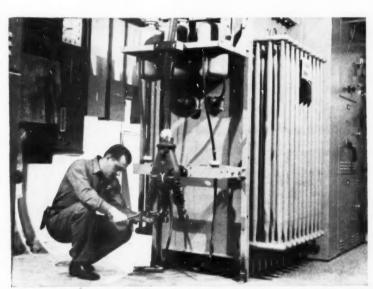
*Reg. Trademark of General Electric Co.

GENERAL ELECTRIC



LIGHTS FOR TV PRODUCTION. Studio construction shot from WWJ-TV's control booth shows battery of lights necessary for televising. Lighting throughout the new station is fed from G-E engineered load centers.

G-E load-center system



CUTOUTS FOR PROTECTION. Engineer wires pothead of incoming high-voltage cable to cutouts on transformer of TV lighting breaker. Oil cutouts are interlocked, cannot be opened or closed with load on transformer.

PENOBSCOT BUILDING—Detroit's highest—houses all of WWJ-TV's transmitter equipment. TV antenna tops highest central portion. Here are transmitted programs originating in new studios powered by G-E load centers.



Take a good look at this New Powerhouse!



LOWEST COST per kilowatt!

HIGHEST OUTPUT per pound!

MOST COMPACT!

Designed to fit every application better...
STANDBY, PORTABLE, MOBILE, STATIONARY

Whatever your need for electric power, the new Onan CW-5 or CW-10 give you top performance and value!

Here for the first time are 5 and 10KW electric plants powered by revolutionary new air-cooled engines, designed and built by Onan exclusively for electric plant use!

Both engines are 1800 R.P.M. The 13 HP Onan engine

Both engines are 1800 R.P.M. The 13 HP Onan engine which powers the CW-5 and the 20 HP Onan engine used for the CW-10 weigh much less than general-purpose engines ordinarily used for electric plants of these capacities and are amazingly compact. Designed and built for heavy-duty use these engines deliver dependable, trouble-free service. Two-cylinder, alternate-firing, opposed design assures smooth, vibration-free power. New, quiet, highly efficient vacuum air cooling drives out all heated air through one side duct. The same duct carries exhaust gases, simplifying installation.

Impulse-coupled, high-tension magneto ignition for quick starting under all conditions. Both models in all standard voltages 60-cycle A.C., single or three phase.

Get the complete story of these all-new electric plants.



- Twin-cylinder, horizontally-opposed, air-cooled, alternate-firing engines
- Aluminum-alloy cylinder heads
- Extra-large, replaceable bearings
- Full-pressure lubrication, 6 quart oil capacity, oilfilter
- Impulse-coupled, high-tension magneto ignition; radio suppressed
- Quiet, vacuum air cooling of generator and engine
- Excellent accessibility, snap-off air housings
- High performance generators
- Completely equipped with controls, instruments

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ELECTRIC PLANTS

Write today for folder and specifications

D. W. ONAN & SONS INC.

3198 UNIVERSITY AVE. S.E., MINNEAPOLIS 14, MINNESOTA



more quality conduit for America's electrical growth

More Pittsburgh Standard quality conduit will soon be on its way to our nation-wide markets, as new production facilities are being added for "the conduit standard of the trade." Pittsburgh Standard's ultra-modern new Morrisville (Pa.) Plant, adjacent to the huge Fairless Works, will mean even faster service, greater tonnage and the same guaranteed perfect conduit.

So widely accepted has been our product name, so fine its reputation, that after 50 years we have changed our company name from Enameled Metals Company to the "brand name" called for wherever quality conduit is used . . . PITTSBURGH STANDARD.

Rigid Steel Conduit and E.M.T.

Electro-Galvanized • Black Enameled Hot Dip Galvanized • Elbows, Nipples, Couplings Briegel E.M.T. Fittings AGENTS IN PRINCIPAL CITIES



CONDUIT

MORRISVILLE, PA. (Philadelphia) PLANT-1952

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Etna, Pa. Morrisville, Pa. **Building or Planning New Construction?**

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PERMITS **UP TO 50%** FUTURE LOAD GROWTH



IT'S THE A.V.C. SANDWICH" THAT MAKES THE DIFFERENCE

Inner Felted Asbestos Wall

Varnished Cambric

Outer Felted Asbestos Wall

New buildings or old, Rockbestos is a dollar-saver, time-

And, best of all, you get this advantage without using more

steel, more man hours or more copper.

stage, is the time to plan for future load growth. By using Rockbestos A.V.C. on a size for size basis with R or RH, you automatically provide up to 50% for future load growth.

Now, when the building is in the construction

saver!



ROCKBESTOS PRODUCTS CORPORATION, NEW HAVEN 4, CONN-

the originators of A.V.C.®

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This "sandwich" protects the varnish cambric. It enables A.V.C. to carry more current than cables with conventional insulations

ONE Screw Holds BOTH Cable and Cap...

and cuts your installed costs when you use #321...90° T&B Tite-Bite Connectors*

One twist—it's open Slip off cap & insert cable Slip cap on & tighten screw ...that's all!

Think of the time and money this new #321 Tite-Bite Connector will save on your wiring jobs. Only one screw! Twist . . . it's open—twist . . . it's closed—tight! Because this one single-turn screw holds both cap and cable, you do a faster, neater job every time.

"Tite-Bite" comes as a single unit . . . no loose parts to drop. Patented hook construction, case-hardened steel locknut and double thick bushing give you safe, sure, trouble-free installation every time . . . for all time! So insist on #321 Tite-Bite Connectors—the new one-screw connector that cuts your installed costs lower than ever before.

ENGINEERED RIGHT...

Tite-Bite Connectors are typical of the many T & B quality fittings recently re-designed to give you outstanding performance at lowest installed costs. Like all T & B fittings, they're furnished under the T & B Plan 100% through your local T & B distributor.

* patented

Remember, you always cut your installed costs by using T & B fittings . . . and by securing them through your local T & B distributor.

THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street,
Elizabeth 1, New Jersey



MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899



PRODUCT

for every

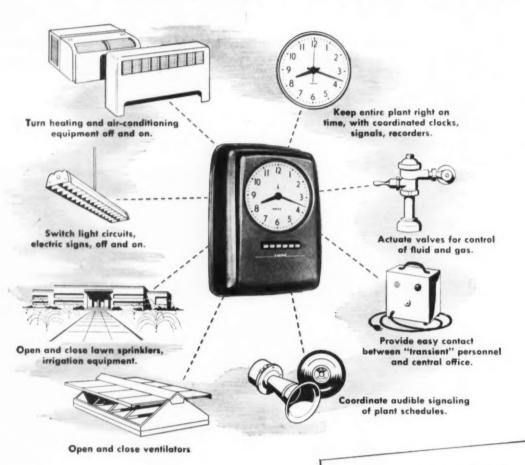
wiring job

in the complete T & B

line of fittings for all

conductors and raceways.

NOW... IBM ELECTRONIC TIME AND PROGRAM CONTROLS FOR UTILITIES CONTROL IN YOUR BUILDING... WITHOUT SPECIAL WIRING



Save you time, steps, effort... conserve fuel, power, water

Without special wiring, versatile IBM Electronic Program Controls—can actually govern operation of facilities in your plant. With intermediate electrical equipment, they will start and stop motors, actuate relays and solenoids—automatically and on pre-set schedule. You save manpower . . . eliminate possibility of human oversight with consequent loss of service and waste of natural resources.

If you have an IBM Electronic Clock and Program System, why not use it to simplify your maintenance work? If not, inquire about IBM Electronic Program Controls to do the job for you. For full details, contact the nearest IBM Branch Office. You are cordially invited to see
IBM Utility Controls at the Plant
Maintenance Show, Public Auditorium,
Cleveland, January 19 - 22.

You're Right ... on TIME ...

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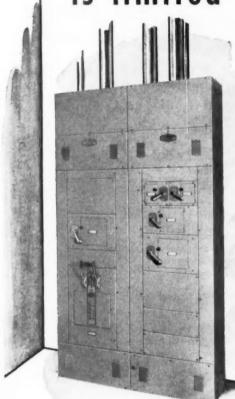
IBM

Time Control

INTERNATIONAL BUSINESS MACHINES
590 Madison Avenue, New York 22, N. Y.

where space

is limited



The R Switchboard, Front-Connected illustrated here is 54'' x 96'' x $14\frac{1}{2}''$ and contains two (2) 60 Amp., one (1) 100 Amp., two (2) 200 Amp., and one (1) 400 Amp. 3 P. Shutlbrak Switches; also space for two (2) 100 Amp. and two (2) 200 Amp. future switches.

® Switchboards, Front-Connected are available in the following types and capacities: SHUTLBRAK — 30 to 1200 amperes, 250 volts AC or DC and 600 volts AC. Rotary type operating handles furnished on 30 to 200 ampere capacities. Straight handles on all others.

KLAMPSWITCHFUZ — 30 to 600 amperes, 250 volts AC or DC.

SNUFARC - 30 to 200 amperes. 600 volts AC.

INSTALL



SWITCHBOARDS front-connected

Like all (A) Switchboards, these space-saving boards are built from standard, preassembled units that fit readily together to form one complete assembly.

Designed for floor mounting against wall, they are constructed of standardized unit type sectional enclosures with integral pull boxes at top and bottom.

Switching units are either Shutlbrak, Klampswitchfuz, or Snufarc, plug-in design, permitting ready interchangeability and replacement without the use of tools.

Want to know more about these light and power distribution units? Your nearest @ representative, listed in Sweets, will be glad to give you complete information.

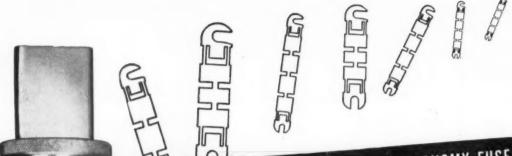
Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS "3, MISSOURI

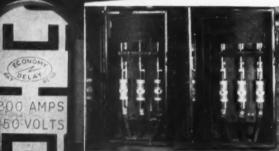
Makess of BUSDUCT . PANELBOARDS . SWITCHBOARDS . SERVICE



Our 61st Year



for FUSE ECONOMY ... use ECONOMY FUSES



YOU SAVE 3WAYS/

FIRST—with "ECONOMY DE-LAY" Renewable Fuses you save money every time you have a current "blow". Simply remove the blown link and replace it at the cost of only a few cents with a new, "ECONOMY DE-LAY" Renewal Link in the same cartridge.

SECOND—you save because of the short time required to make this replacement—and time is money.

THIRD—you save by reducing "down time" on machines—because an inexpensive carton of Economy Fuse Renewal Links kept on hand 24 hours a day, answers fuse renewal requirements immediately.

Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

Ask for the Economy Catalog and Price List.



ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPPRESENTATIVES IN

FREE booklet

answers 17 most frequently-asked questions about this label on

industrial lighting units,

such as:



The "R" stands for Reflector, the "L" for Lighting equipment and the "M" for Manufacturers—Reflector and Lighting Equipment Manufacturers.

How does the RLM Label assure conformance to RLM Standards?

A Representatives of the Electrical Testing Laboratories periodically visit the plants of all manufacturers participating in the RLM Specification-Certification Program. These ETL inspectors are authorized to take lighting units right off the assembly line or out of stock at random and make the required tests. They may also obtain test samples direct from distributors' stocks in order to check conformance to RLM minimum standards.

Who are the Electrical Testing

Electrical Testing Laboratories, Inc., 2, East End Ave., New York 21, N. Y., is an independent testing organization which has conspicuously served industry for over 50 years. With this impartial and scientific organization rests the sole responsibility of determining whether or not an industrial lighting unit measures up to every individual quality standard that qualifies it to bear the RLM Label.

What are the 4 Basic Tests made by Electrical Testing Laboratories?

(1) Quality of reflecting surface, (2) Reflection factor, (3) Shielding angle and reflector dimensions, and (4) Photometric test for light distribution and efficiency.

What does the RLM Label stand for?

The label affixed to a lighting unit certifies that the reflector meets the minimum specification and performance standards, determined and established by the RLM Standards Institute.

Who sponsors the RLM Standards Institute?

A Incorporated as a non-profit organization, the Institute is sponsored by 28 manufacturers who voluntarily elect to manufacture industrial lighting equipment in accordance with RLM Standard Specifications.

How are RLM Standard Specifications established?

The RLM Technical Committee, with the counsel of outstanding illuminating engineers, continuously reviews present specifications and suggests improvements and prepares new specifications. The Committee's recommendations then are reviewed by the Board of Trustees and finally submitted to the Institute Members for ratification. The adoption of new specifications requires approval by at least 80% of the membership.

In addition to design and construction features that meet certain minimum standards, what else does the RLM Label assure the buyer?

the RLM label

It provides the buyer with a warranty of uniform quality. In addition to the periodical inspections and tests made by the Electrical Testing Laboratories, the manufacturer warrants that every unit shipped by him meets the published specifications of the Institute.

How many different types and sizes of RLM Units are there?

There are 18 basic types of RLM Units made by one or more of the 28 member-manufacturers. At present there is available a total of over 320 different makes and types of units which either bear the RLM Label or are on submittal for testing and certification at Electrical Testing Laboratories.

How may I obtain free copies of all existing RLM Specifications and a check list of RLM-Member Manufacturers?

Send for the 48-page RLM Specifications Book and the new Question and Answer booklet. Write RLM Standards Institute, Suite 819, 326 W. Madison St., Chicago 6, Ill. Your copies will be mailed without cost or obligation.



R5370RR



Whose cheese is being divided?

TWO cats could not agree on fair division of a tasty cheese. "Let's go to the monkey," said one, "He is all-wise and can divide our cheese fairly." So to the monkey they went.

The monkey immediately broke the cheese evenly and judicially put the two pieces on the pans of his balance. But one was slightly heavier. He shrewdly nibbled that piece a bit and put it back on the scales. Now it was the lighter piece. So he bit off some of the other piece only to find it the lighter. Thus while the two hungry cats watched, the monkey kept taking bites of the cheese, first one piece, then the other, until finally the cheese had almost disappeared.

"What's left is too small to divide," sagely pronounced the monkey, as he popped the remaining fragments into his mouth. Observers of the American scene see a direct parallel between the record of federal taxation and this ancient parable of the trusting cats, the greedy monkey and the cheese. Business and the individual citizen have been content to trust government to rule on the disposition of their earnings. And Uncle Sam keeps taking bite after bite out of the shares of both individual citizen and business.

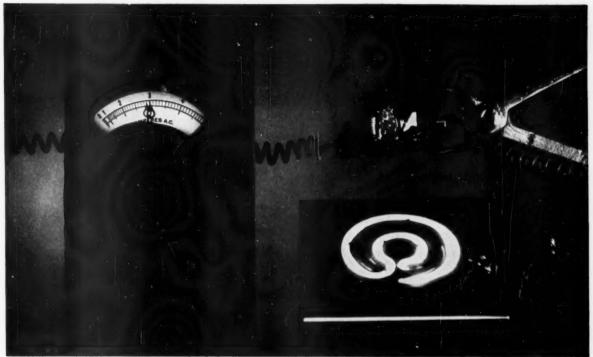
Already government bites are so large as to severely penalize citizens and business alike. If allowed to continue, it will seriously impede further industrial progress and growth, stifle initiative and threaten the strength of our free enterprise system. Beware the day—goal of the socialists among us—when the monkey says, "What's left is too small to divide."



The Youngstown Sheet and Tube Company

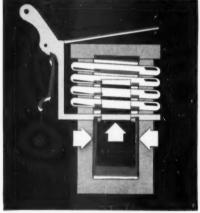
General Offices -- Youngstown 1, Ohio
Export Offices -- 500 Fifth Avenue, New York
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES,



Laboratory demonstration shows 30 amperes continuously flowing through 30 ampere Heinemann Circuit Breaker held over hot plate.

the one circuit breaker principle ...THAT IGNORES HEAT!



The FULLY MAGNETIC Principle

One magnetic coil is the entire actuation of HEINEMANN Circuit Breakers. Thermal warp elements are eliminated. On short circuits, the coil instantly trips the breaker. On small overloads, a time delay is introduced while the movable core is drawn toward the pole piece, increasing the magnetic flux. Moreover, the time delay is proportioned to the overload... being shorter for large overloads... and longer for small ones.

HEAT... the downfall of most circuit protection equipment... will not alter the performance of Heinemann Circuit Breakers. You can locate Heinemann Circuit Breakers in hot kitchens, boiler rooms, or near steam pipes without fear of false tripping. With Heinemann, current is the only consideration... and current (not heat) trips the breaker. There is no need for de-rating... never nuisance tripping, yet Heinemann provides the fastest circuit interruption available for short circuits and proportioned response for overloads.

Performance and dependability to this extent explains why better contractors are using Heinemann Circuit Breakers on their jobs.

Send for complete literature. HEINEMANN ELECTRIC COMPANY, 132 Plum Street, Trenton 2, N.J.

don't use heat... USE POWER



HEINEMANN Circuit Breakers . . One, two and three pole . . 10 milliamps to 100 amperes



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Receptacles . . . Caps Connectors

"A Turn of the Cap and It's Locked" USE P&S TURNLOK — wherever the uninterrupted flow of electrical current means TIME SAVED — MONEY SAVED — INCREASED SAFETY. Designed for quick, easy wiring — with added safety features — P&S Turnlok will give years of trouble-free service.

YOURS FOR THE ASKING

The new 8-page descriptive manual with complete illustrations, dimensional and catalog information. Just drop us a line on your letterhead.

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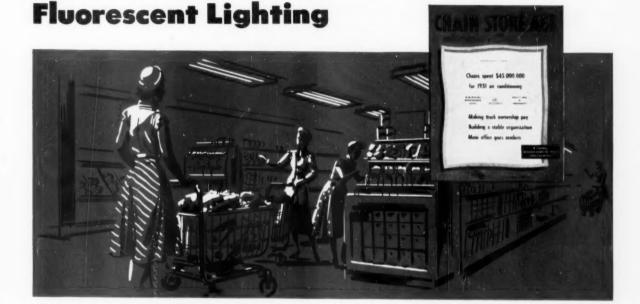
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Chain Store Age

Recommends CERTIFIED BALLASTS for



CHAIN STORE AGE, in advising chain store operators on their selection of fluorescent lighting equipment, said:

"The ballast is the heart of a fixture. The surest way to choose a ballast is to look for the Certified shield . . . it is the only assurance of long lamp life. Inferior ballasts delivering wrong wattages result in low light output."

Experience has proved that CERTIFIED BALLASTS assure:

Full Lamp Life

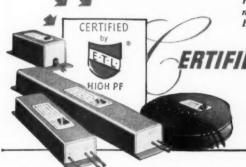
Rated Light Output

Maximum Ballast Life

CERTIFIED BALLASTS are made to precise specifications, then tested by Electrical Testing Laboratories, Inc., which certifies they conform to these high standards.

Write for complete information on the types of CERTIFIED BALLASTS available from each participating manufacturer.

Participation in the CERTIFIED BALLAST program is open to any manufacturer who complies with the requirements of CERTIFIED BALLAST MANUFACTURERS.

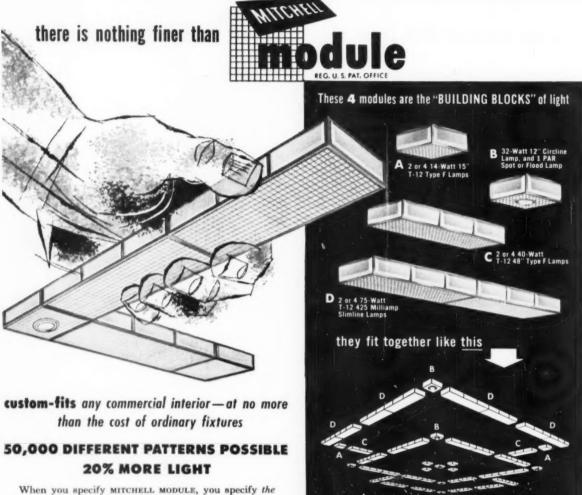


ERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting

2116 KEITH BLDG., CLEVELAND 15, OHIO

Where the installation calls for exceptional commercial lighting



When you specify MITCHELL MODULE, you specify the best in ultra-modern commercial lighting. It's a revelation: with just 4 simple, low-cost "building blocks of light", MITCHELL MODULE offers unlimited lighting patterns to custom-fit any commercial interior. MODULE'S exclusive plastic louver passes 20 % MORE LIGHT. Units fit together simply (mechanically and electrically) for quick, low-cost installation, and for easy rearrangement of patterns to suit changing needs. MODULE mixes all light sources smoothly in one harmonious, beautiful system—puts the light exactly where it's needed. No ordinary fixtures can match MODULE—the only lighting that custom-fits with standard low-cost units.

Only MITCHELL makes MODULE

There's nothing in lighting easier to specify, easier to sell than MODULE. It custom-fits and "grows" with every lighting need, it delivers MORE LIGHT, it stays beautiful, new; it costs no more than ordinary fixtures. It's America's No. 1 Commercial Lighting with exclusive advantages for architects, wholesalers, contractors, utility consultants and users. Yau'll want the facts about MODULE—write today for full descriptive catalogs.





for lighting magic like this

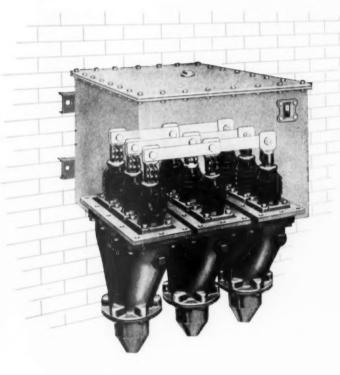
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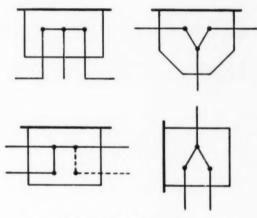
2525 North Clybourn Avenue, Chicago 14, Illinois In Canada: Mitchell Mfg. Co., Ltd., 19 Waterman Ave., Toronto DON'T CUT THOSE CABLES!

SAVE TIME AND MONEY BY INSTALLING

TYPE "OL" CABLE BOXES TO PROVIDE

DISCONNECTING LINKS FOR SECTIONALIZING.





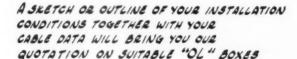
"OL" CABLE BOXES

Heavy welded steel boxes with "Resistoyl" gasketed covers. Fitted with unit compound filled potheads for complete protection of cable ends. Location of potheads varied to suit installation conditions.

Boxes are filled with oil (or Askarel)—for minimum size and best electric characteristics.

"OL" boxes meet many requirements for nonload break sectionalizing and stop joint connection of cables up to 66 Kv.

Send for new Bulletin BA52 on CABLE BOXES. (Page 10 lists "OL" boxes rated 15 Ky).





ELECTRIC SPECIALTY CO.

7780 Dante Avenue, Chicago 19, III.

Cable Terminating, Connecting and Sectionalizing Devices
Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices, Ltd., Teroate and Montreal



EASY TO INSTALL, G-E L-69 FLOODLIGHTS DOUBLE USE OF RECREATION AREA.

G-E L-69 floodlights for lower installation costs

EASY INSTALLATION. You save money by saving time when you install competitively priced G-E L-69 1500W Floodlights. From the simple two-bolt mounting to the convenient beam sight for fast daylight aiming, the lightweight G-E L-69 is designed so that it will cut your costs by simplifying your installation. On many installations, the floodlight can even be aimed while the pole is on the ground, with easy to read horizontal and vertical degree scales.

And with the G-E L-69, you do a quality lighting job that soon pays off in more lighting business for you.

ECONOMICAL MAINTENANCE. Built in wrench type handle on the G-E L-69 completely eliminates the need for tools. Both relamping and cleaning are fast and easy, and the G-E L-69 delivers more light per unit, more light per watt, than any other

comparable lighting unit obtainable anywhere.

PROMPT DELIVERY. You can get the G-E L-69 right out of stock at shipping points throughout the country. Whatever your lighting requirements, there's a light in G.E.'s complete and comprehensive line to precisely fit your particular needs. And if you need help, you can get it from G.E.'s staff of lighting specialists.

USEFUL INFORMATION is yours for the asking. NEMA approved floodlighting plans for all sports are contained in GET-1284; effective industrial uses are explained in GEA-3640D; and Bulletins GEC-533B and GEC-919 give complete details on the L-69 sports and area floodlight. Just write Section 451-179, General Electric Co., Schenectady 5, New York.







NO TOOLS required for initial positioning or maintenance, with built in wrench-type handle. Large area clamping action holds against vibration.



EASY AIMING possible even during daylight with G-E L-69's convenient beam sight... puts the light in the right place, saves time.



NO BREAKAGE with spun-on, impact resisting tempered plate glass, which won't break if struck by hall, and keeps out water, dirt, insects.



EASY CLEANING and relamping! Just flick hand toggle latches, clamp socket housing to trunnion bracket. Hands are free to service light.

Thousands of Electrical Experts

—in contractors' organizations, industrial plants and service shops

Have Helped

Accumulate More Than "50 Years of Motor Know-How"

FOR TOP PERFORMANCE...
LONG MOTOR LIFE...SATISFIED USERS

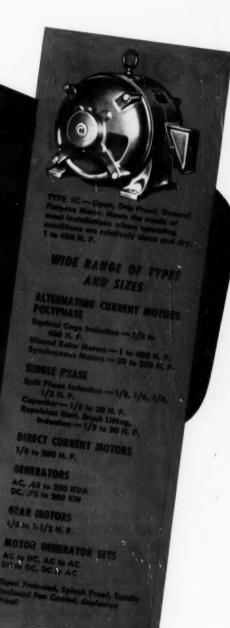
You can tailor your motor specifications from:

- 6 Basic types of motors.
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- 4 Standard classes of starting torque characteristics.
- 6 Methods of speed control.
- Constant and short time ratings.
- A dozen methods of mounting the motor.
- Insulated to resist dampness and humid climates.
- Unusually quiet starting and running for the air-conditioning field.
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- 1/8 to 400 H. P. ratings.



Century's 28 branch offices and national network of authorized distributors, also authorized service stations, will serve your needs promptly.

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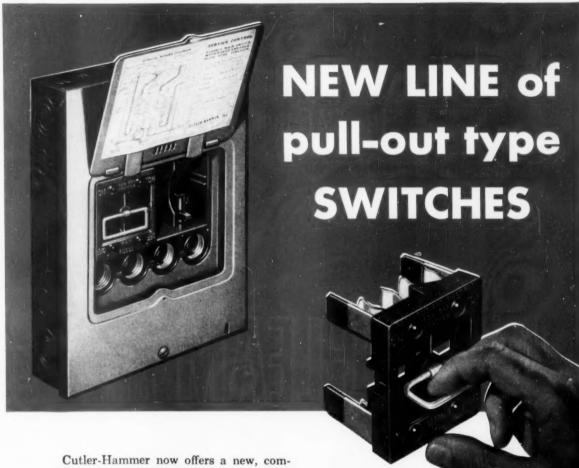
YOU HAVE TO GO INSIDE

Almost all cables look alike on the outside. You have to go inside the jacket to the insulation if you want to see how good the cable really is. In power cables it's the insulation that makes the difference. This fact may be borne out in years of service or as a result of rigorous laboratory tests.

ANHYDREX SA insulation is guaranteed not to absorb more than 20 milligrams of water when soaked at $158^{\circ}F$. ($70^{\circ}C$.). Its dielectric constant will not exceed 3.2 after one day's immersion in water at $158^{\circ}F$. ($70^{\circ}C$.). Between one day and eight days' immersion in water at $158^{\circ}F$. ($70^{\circ}C$.), the increase of capacitance will not exceed 3.5% for insulation thicknesses greater than 4.64" or 5% for insulation thicknesses of 4/64" or less. At the end of eight days in water at $158^{\circ}F$. ($70^{\circ}C$.) the power factor will not exceed 1%.

No ANHYDREX cable has ever failed due to water absorption. There is no better proof that the electrical properties of ANHYDREX SA insulation remain remarkably stable in the presence of water for a long period of time. Specify ANHYDREX SA insulated cables for underground, duct, or aerial installations at voltages up to 2000 V.W.P. For more complete information, contact your nearest Simplex representative or write to the address below.





Cutler-Hammer now offers a new, complete and comprehensive line of pull-out type main and range switches. It provides features to help the contractor do a better job for his customers and an easier, more profitable job for himself.

This new line is available with main and range plus 4, 6 and 8 plug fuse circuits, in surface or flush mounting with the shallow case that fits modern wall construction... and in various types of enclosures.

There are 76 knockouts in each case, ranging from ¼" to 1¼"; the easy to remove interior which slips out after you loosen one screw, provides more wiring space; easy-tite wire holes; solderless connectors for "tap off"; a clear, easy-to-read, easy-to-follow wiring diagram; and a one screw cover mounting for the surface types.

Customers like the easy and safe access

to fuses; the good-grip pull-out handle that makes pull-out easy to remove for fuse replacement in emergency. Customers like the better appearance, harmonizing with any home decoration scheme. And they like the dependable, trouble-free service resulting from features like silver plated contacts, ample contact area, and cool operation. They know that the name Cutler-Hammer on the case, advertised for many years in Saturday Evening Post, Better Homes & Gardens, etc. means more for the same money. They respect the contractor that handles this kind of equipment. Featured by leading distributors from coast to coast. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.





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-an all new product, inside and outside!

- Inside: Wire pulling easier than ever with the new smoother, protective coating of resinous lacquer compounded with Zirconium, Corrosion resistance plus assured grounding.
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SPANÎLEAM

-tops in the field!

- · easier to cut
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- · lightweight
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SPANGLEAM

—available immediately in the full range of six sizes:

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PROSPERITY in the USA: Who Has It?

How prosperous are the people of the United States?

The previous editorial in this series answered this question for the average American. His prosperity has increased only slightly in recent years.

But the average tells only a part, and in many ways not the most important part of the story. Which individuals and groups have prospered more, which less? (The average, the result of a statistical calculation rather than a creation of flesh and blood, tells nothing about that.)

The purpose of this message is solely to get at the facts on this question of how prosperity is distributed. This is not easy. In spite of the crucial importance of the subject, the available information is limited. Even so it is possible to provide a rough answer to the question, "Who has the prosperity?"

We Have Had a Revolution

The distribution of income in the United States has changed so greatly in the past twenty years that Arthur F. Burns, Research Director of the National Bureau of Economic Research, world renowned for its impartiality and technical competence, calls it "one of the great social revolutions of history." A part of this revolution is portrayed by the following table which shows that individual incomes are both much larger and much more evenly

distributed than they were twenty years ago. Clearly, a large new middle-class has been created.

DISTRIBUTION OF REAL INCOME

Dollars of Income*	Per Cent of Families in Each Income Group	
and the same	1929	1951
Under 1,000	17%	13%
1,000 - 2,000	24	15
2,000 — 3,000	24	18
3,000 - 4,000	14	18
4,000 - 5,000	6	15
5,000 - 7,500	9	14
500 and over 6		7
	100%	100%

*Adjusted for price changes to give the dollar its 1951 purchasing power.

Some light on why this income revolution has taken place can be found by tracing incomes to their source. Since 1929, for instance, employees have clearly made the biggest gains in total income. This can be seen in the next table. People who own their own businesses have done second best. Farmers, who are often thought to be doing handsomely indeed, have been outstripped in the income race by employees and businessmen. People whose incomes depend upon pensions, insurance policies, and other relatively fixed returns such as rent, interest and dividends have lagged far behind.

HOW REAL INCOME HAS CHANGED*

Types of Income	Percentage Change 1929 to 1951	
Wages & salaries of employees.	+123%	
Income of professional men & unincorporated business	+108	
Farm operators' income	+ 56	
Rental income	+1	
Dividends	+2	
Interest	-35	

*In this and the previous table account is taken of changes in the cost of living. But adjustment for the changing tax load was not possible, as it is in the computations which follow.

The Biggest Gains

Employees have made the biggest gains in income, but the term "employees" covers a wide assortment of people-from the presidents of the biggest corporations to factory sweepers. How have different groups of employees prospered? Some indication is provided by results of a survey of salaries in 41 corporations made by Arch Patton of McKinsey and Company and recently summarized in the Harvard Business Review. This survey showed that between 1939 and 1950, after adjustment both for higher living costs and for higher taxes, factory and office employees made modest gains in income while management personnel suffered losses ranging from 40% to 60%.

While factory and office workers generally have made greater income gains than others, their gains have varied greatly from industry to industry. During the past five years, for example, steel workers' take-home pay (adjusted for both taxes and price changes) has increased by 22%, that of textile workers 9%, employees of general merchandise stores 4%, and that of laundry workers not at all.

What About Organization?

How have organized workers fared compared to unorganized workers? There is no round-up of facts that makes possible a direct comparison between the two. Such evidence as there is shows it is indeed an open question whether union members have done any better than others. Steel workers, for instance, who are strongly unionized are among the highly paid manufacturing workers. Farm workers are generally not unionized, and they work

in one of the most competitive industries in

But farm workers have made income gains which far surpass those of steel workers. Real wages of farm workers increased $2\frac{1}{2}$ times more than those in the steel industry between 1939 and 1952. This fact may prove nothing more than that, in a period of inflation and manpower shortage, the less skilled workers whose incomes are ordinarily low, make the biggest percentage gain in income. Further support for this conclusion is found in the construction industry where real wages of unskilled labor increased 37% between 1939 and 1952, while those of skilled labor increased only 4%.

Why Most Incomes Are Higher

Prosperity, who has it? We may conclude that workers have been getting much more of it lately than managers or property owners, that unskilled wage and salary earners have made the largest gains, and that income generally is much more evenly distributed.

Where has the money come from to raise low bracket incomes? It has come partly from an increase in the total national income, but partly also from cutting down the share received by people in the highest income brackets. While the top 5% received 33.5% of the income after taxes in 1929, their share of income has now been cut about in half. For every \$11 of increase in income to the lower 95% of income receivers, about \$7 has come from increased production, and about \$4 by taking that amount from the top 5%.

Top bracket incomes have now been cut so deeply that the possibilities of increasing the income of the rest of the people by "soaking the rich" have largely disappeared. Indeed, if all of the income after taxes of everyone earning over \$25,000 in 1951 was taken away and redistributed among the remaining Americans, each person would receive only about \$65.

The significance of this revolution in income distribution is clear. It is that there is only one way by which the great mass of us Americans can continue to increase our individual prosperity. This is by earning the increase through more and more efficient production. In plotting the economic course of the U.S.A. this fact is of decisive consequence.

McGraw-Hill Publishing Company, Inc.

OPEN LIKE A LATTICE DIFFUSING LIKE GLASS uth GrateLite Louvre the latest idea in lighting A SYMPHONY OF DIFFUSED LIGHT * U.S. & Can. Pats. Pend. The first integral plastic louvre for fluorescent lighting, molded of LUSTREX polystyrene. It reveals a new conception of architectural beauty and efficient lighting: Its diffusion results from the %" cubical lattice that cuts off direct light at a 45° angle. But words alone cannot describe beauty. See for yourself and ask to be shown a sample. It will give you a new outlook on lighting. GrateLite is tough, quickly cleaned and de-staticized. It is furnished in one piece with Guth Fluorescent Fixtures. LEADERS PEER LITE THE EDWIN F. GUTH COMPANY . ST. LOUIS 3, MO. SINCE 1902



get the <u>best</u> in a time switch choose a Sangamo!

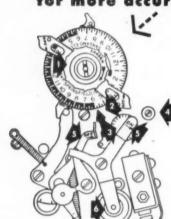
For automatic on-off time control on installations where you can't afford a failure—choose a Sangamo Time Switch. These high quality switches have a reputation for giving greater value—for offering efficient, unfailing on-off control for years and years in the most exacting installations.

There's a good reason why Sangamo Time Switches are so universally recognized as the finest—they were *never* built to merely meet minimum requirements!

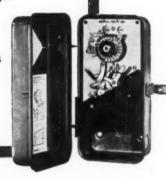
Sangamo Heavy Duty Time Switches provide a considerable *extra* margin of dependability at only slightly higher cost. They are available for almost any conceivable application, from the simplest on-off operation to complex multi-operation schedules.

here's the reason...

for more accurate, positive time settings:



- 1. Locking knob facilitates accurate settings of time levers.
- 2. Red time indicating pointer readily visible.
- 3. Minute indicator for closer settings.
- Vernier setting for greater accuracy.
- Manual On and Off tripping levers clearly marked.
- Roller provides friction-free contact operation.





SANGAMO

ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

* Your electrical wholesaler can furnish all types of dependable Sangamo Time Switches. See them before you specify the time control for your next installation. Bulletin 1010 tells the full story—write today.

for your most exacting installations -

Now.

added to the Silvray line of special-effect lighting units —

THE RECESSED DOWNLIGHT

Featuring complete concealment of the light source, this compact Silver-dot unit rounds out Silvray's line of allpurpose incandescent downlights.

Employing a 4" ceiling aperture for passage of a precisely-focused light beam, the Silver-dot is ideally suited for supplementary accent or specialeffect lighting in commercial and residential interiors.

Silver-dot units are designed for use with the new 100-watt A-21 clear silvered-bowl lamp. They produce more candle power than equipment using 150-watt reflector or projector lamps ... use less energy ... generate less heat.

Placed 6' above the surface to be lighted, for example, the Silver-dot casts a 6' glare-free light circle. Relamping, without removing the ceiling plate, restores the unit to initial efficiency.

Easy to install, the Silver-dot requires a ceiling opening only 61/2" in diameter...a recess depth of only 71/4".









THE SILVER-SPOT

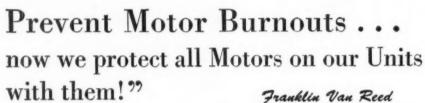
satile, general-purpose downlight is available for both recessed and surface-mounted installations. 101/4" in diameter, the Silverspot requires an opening depth of only 51/4" for complete recessing . . . projects only 31/2" when surface mounted. Precision light control of built-in reflector eliminates glare and wasted spill light. Louvre provides 45° shielding.

THE SILVER-SPOT ADAPTOR

Companion piece to the Silver-dot, this ver- Designed as a portable unit, this 8" diameter version of the Silver-spot is equipped with a "screw-in" adaptor base to fit standard porcelain receptacles or swivel fittings. Both the Silver-spot and Silver-spot Adaptor unit use the 100-watt A-21 lamp to obtain the warm color quality so much in demand by merchandising experts. Both units are easily convertible to either floodlight or spotlight distribution.

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Please	send me fu	rther info	ormation on	Silver-	spot and Silver-dot units.
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"Experience showed us how FUSETRON FUSES



Production Engineering Supervisor ORR & SEMBOWER, INC., Reading, Penn.



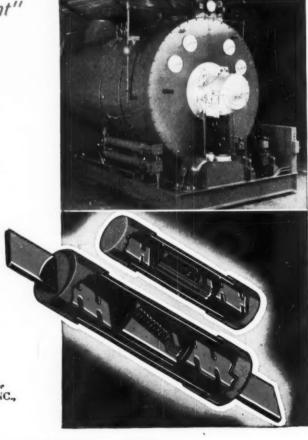
Back in January of 1951 we had a motor on a pump that was supposed to draw a maximum load of about 8 amperes, yet it began blowing FUSETRON fuses of motor protection size.

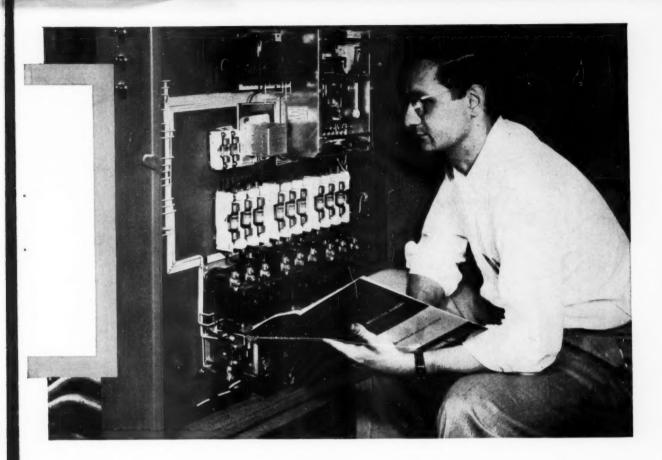
"We were inclined to believe something was wrong with the fuses but after checking with an ammeter we found that an automatic relief by-pass was sticking and causing the motor to draw about 12 amperes.

"If the Fusetron fuses had not opened, the motor would undoubtedly have burned out.

"Now on all our Powermaster Steam Generator Units we use Fusetron Fuses to protect the motors on the fuel pump, the boiler feedwater makeup pump, and the air compressor."

> Franklin Van Reed Production Engineering Supervisor ORR & SEMBOWER, INC., Reading, Pennsylvania





You, too, can profit by the 10 POINT PROTECTION of Fusetron Dual-Element Fuses...

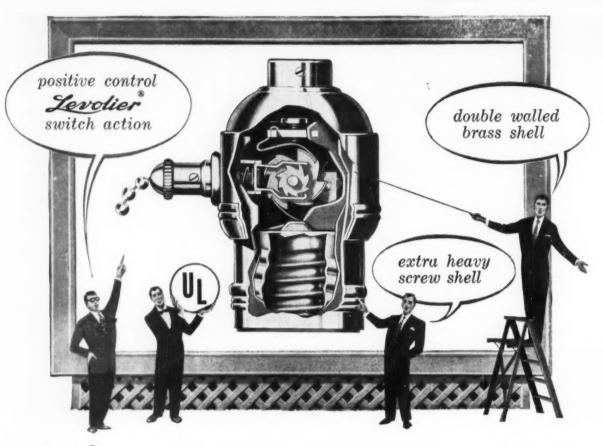
- 1 Protect against short-circuits.*
- 2 Protect against needless blows caused by harmless overloads.
- 3 Protect against needless blows caused by excessive heating lesser resistance results in much cooler operation.
- 4 Provide thermal protection for panels and switches against damage from heating due to poor contact.
- 5 Protect motors against burnout from over-loading.
- 6 Protect motors against burnout due to single phasing.
- 7 Give DOUBLE burnout protection to large motors — without extra cost.
- 8 Make protection of small motors simple and inexpensive.
- 9 Protect against waste of space and money permit use of proper size switches and panels.
- 10 Protect coils, transformers and solenoids against burnout.
 - *Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co. THE MONEY YOU SAVE . . . by preventing one needless shutdown, one lost motor, one destroyed switch or panel or one burned out solenoid . . . MAY MORE THAN PAY FOR the replacement of all your ordinary fuses with Fusetron dual-element Fuses.

THIS COUPON WILL BRING YOU complete information about the All-Purpose Protection of FUSETRON Dual-Element FUSES

FUSETRON
TRUSTWORTHY NAMES IN
ELECTRICAL PROTECTION

Bussmann A St. Louis 7,	Mfg. Co., University at Jefferson, Mo. (Division of McGraw Electric Co.)
Please sens	d me complete facts about FUSETRON dual-element Fuses
Name	
Title	



at last! a socket that refuses to wear out



to save you replacement costs

Model 4100 Here is a heavy-duty, double-walled industrial socket that will withstand the hard wear and abuse of strenuous industrial applications. Its use eliminates frequent socket replacement, costly maintenance and production time losses.

McGill No. 4100 Sockets are equipped with the proven dependable Levolier Switch mechanism .006" heavier screw shell, button contact, and numerous other design advantages not available in ordinary sockets. Brushed brass finish, ½", ½" and pendant cap, bead chain or plain lever.

Send for the new McGill Catalog No. 49-A describing the complete line of McGill Sockets, Switches and Lamp Guards.





McGILL MANUFACTURING CO., INC. 450 N. Campbell St., Valparaiso, Ind.

and 41 Switch.
Colorful Molded Phenolic.



Trumbull TQL Plug-in Breakers from 10 through 50 amp. ratings are all made to the same standard dimensions — physically interchangeable not only in Trumbull Load Centers and Panelboards but also dimensions of these breakers have been adopted by leading manufacturers. This means convenience, economy and time saving for the contractor or plant electrician.

Trumbull also sets the quality and safety standard with a thermal-magnetic trip for positive protection against both shorts and sustained overloads. Compact and economical to buy and install. They pay for themselves because they are built to last a lifetime. They pay big dividends in letting you restore service quickly after short or overload is corrected. They may well save a capital investment by prevention of overheated circuits.

Quick Facts

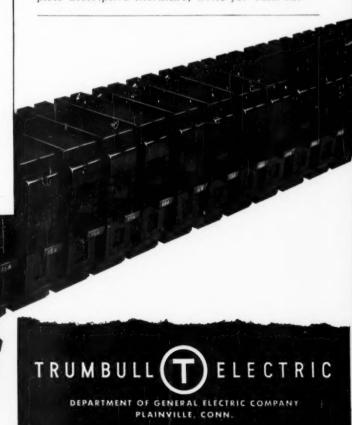
- · Quick-make, Quick-break
- Trip indicating, trip free handle, with stamped rating



11

- Positive arc-quenching and extended exhaust chamber
- Tamperproof, sealed factory calibration
- Double pole operation with handle extensions
- Underwriters' Laboratories Approved for feeding through line or load terminal
- Ratings: 10, 15, 20, 30, 40 and 50 amp., 120 volt A.C., single pole
- Interrupting ratings: 5000 amp., 120 volt A.C., single pole; 120/240 volt A.C., double pole
- Size: 2-27/32 x 31/32 x 2-15/16 (over handle)

Leading Electrical Distributors everywhere stock Trumbull equipment. See your local Trumbull Distributor for top values and alert service. For complete descriptive literature, write for TEB-12.

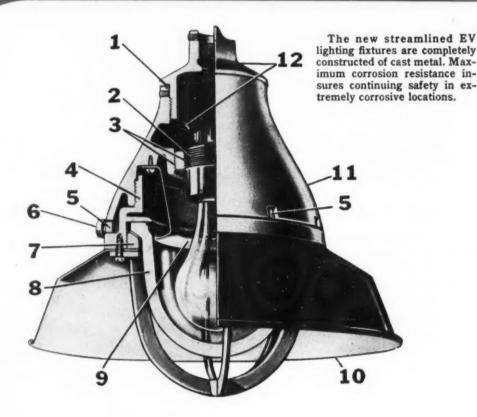


CROUSE-HINDS EV Series

have been redesigned to give you:

EASIEST installation
EASIEST maintenance
HIGHEST efficiency

This adds up to big savings on every installation!



- Rubber O-ring gasket . . . seals joint against dirt or liquids.
- New improved shock-absorbing receptacle has "universal" action . . . absorbs shock from any direction.
- Threaded joints are flame tight . . . no sealing compound or external seals are required.
- Lightweight one-piece assembly of globe, holder, guard and reflector is threaded high up inside of hood ..., no liquid or dirt can enter.
- Notches in hood and globe holder . . . easy to loosen with a screwdriver.

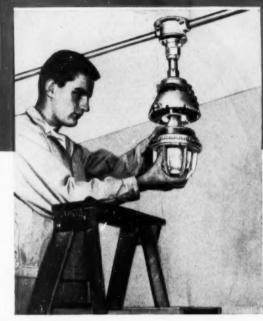
- Large knurled thumb screw . . . sets between notches for positive locking.
- 7. Globe retaining ring and cushioning gasket.
- 8. Heat and impact resisting globe. The accurately ground flange, essential for safety, is protected in a factory assembled joint . . . never exposed to damage.
- Auxiliary reflector . . . etched Alzak aluminum . . . eliminates "trapped" light.
- 10. Porcelain enameled steel reflector.
- 11. Cast aluminum hood.
- Cast aluminum body . . . has two openings for easier wiring from either side.

CONDULETS

AIRPORT LIGHTING

Explosion-Proof LIGHTING FIXTURES





Easiest Relamping—3 Simple Steps

1. Single unit globe-holder assembly threaded into fixture hood is quickly removable for relamping. Slots are provided for prying with a screw-driver when necessary in corrosive atmospheres or other severe conditions. A large knurled thumb screw is easily loosened to unlock the globe and holder.

The new design of EV Explosion-Proof Lighting Fixtures is based on exhaustive studies and tests in Crouse-Hinds laboratories. The goal was to produce a fixture that would be easier to install and easier to relamp than any other explosion-proof fixture. Crouse-Hinds designers not only achieved this result but also created a fixture having the highest possible lighting efficiency.

You get 3-way savings when you install Crouse-Hinds EV Lighting Fixtures: quicker installation; quicker relamping; more light. This makes them the best buy for lighting in any location that is hazardous because of the possibility of the presence of flammable atmospheres. Use them on every job and have the best!

CROUSE-HINDS COMPANY Syracuse 1, N. Y.

OFFICES Birmingham — Boston — Buffalo — Chicago — Cincianati — Cleveland — Dative Detroit — Houston — Indianapolis — Kanasa City — Les Angles — Milmeutse — Minneapolis New Orleans — New York — Philodelphia — Pittaburgh — Portland, Oze — Son Francisco — Seattle St. Louis — Tula — Washington — BESIDENT REPRESENTATIVES: Albary — Atlanta Baltimore — Charlete — Corpus Christi — Michande Va — Shavesport — Crouse Hinds Company of Canada Ltd., Toronto, Oza

 Globe and holder complete with guard (and reflector if used) is removed as an assembly. Only one lightweight piece to handle—globe retained in holder with flametight joint fully protected. Explosion-proof integrity assured. The 200/300-watt globe-holder assembly weighs but 8 lbs.



 In relamping only a lamp is carried up and down the ladder and one assembly handled. It is not necessary to stock any spare parts or assemblies for complete convenience.



For Permanent Installations
For Profitable Work

Belden Inter-com CABLE

Belden Manufacturing Co., 4623-A W. Yan Buren St., Chicago 44, Illinois

Washington Report

Economic stability is a stated goal of the in-coming Republican Administration. This means Eisenhower will fight further inflation, prevent continuing shrinkage of the value of the dollar, and take positive action against deflation, or recession.

Eisenhower and Congress will cut Truman's 1954 budget request of \$80 billion (estimated) to about \$70 billion, force economies in government. This will be more in line with Federal income—provide a balanced budget for fiscal year starting next July 1. Eisenhower will probably ask for tax reductions, but sentiment in Congress is for a balanced budget first.

With economists generally predicting record business for the first six months of this year, these new Administration goals will contribute to a better business climate for several months ahead, well into 1954.

Record plant and equipment outlays are predicted for the first three months of this year, according to a recent joint Securities Exchange Commission-Commerce Department survey. Businessmen plan to spend at the annual rate of \$28.7 billion during the first quarter, it is reported.

Entertainment construction in 1953 will total over \$250 million, NPA estimates, and will cover the resumed construction of theatres, skating rinks, country clubs, playgrounds and other amusement and recreation projects. Construction of these types of projects was allowed to be resumed January 1, after having been banned since October 26, 1950. This easing of construction curbs was provided in Direction 8 to Revised CMP Reg. 6, issued December 10, 1952 (See "Construction Controls Eased", page 207).

Certificates of necessity for accelerated tax amortization had been issued covering 14,748 new or expanded facilities since the beginning of the program up to December 3, 1952, DPA announced. These projects involved a total dollar value of approximately \$23.7 billion, of which \$14.5 billion, or 61%, was approved for rapid depreciation. Of this total, 556 were electric power projects with an estimated total cost of \$3.4 billion, of which \$1.5 billion, or 45.1% was certified for rapid tax write-off. These electric power projects will increase the Nation's electric power supply by 19.7 million kilowatts, DEPA reported. Applications for 193 electric power projects, having an estimated cost of \$174.4 million have been denied.

Home building starts last year exceeded 1,125,000, some 25,000 more than in 1951. In November 86,000 new dwelling units were put in place, BLS reports, down 15% from October but 15% above November 1951. Predictions are for about 1½-million new homes this year, at a slightly higher cost average, and of a better quality.

Selenium rectifier manufacturers recently asked NPA to retain its controls order (NPA Order M-91) on selenium as long as there is a shortage of this rare element. They also suggested that inventory restrictions be relaxed to permit a 60 day supply, that allocations be made quarterly instead of monthly, and that self-authorization allowances be increased from one pound a month to 20 pounds a month.

OPS personnel on January 1 was 5,650, and plans were to reduce this staff to 4,125 by January 31. This cut was made to allow the Price Agency to live within the budget allotted by Congress (\$37 million) until price-wage controls expire April 30, or until it is put out of business earlier by the incoming Administration (See "Outlook for '53, page 81).

longer life zinc protected threads

Sherarduct RIGID STEEL CONDUIT

rust-proof electrical system to keep wiring safe

Yes, even at the base of the clean, sharp threads of Sherarduct Rigid Steel Conduit you have full zinc protection. No need to worry about threads rusting even before you install it—not when you use SHERARDUCT!

The special sherardizing process of dry galvanizing permanently protects the conduit by actually alloying zinc to the steel walls. Both conduit and couplings have clean-cut, rust-proofed threads.

Pin hole rust spots can't form on the threads of Sherarduct—thus eliminating the one place most likely to endanger the life of a conduit system. When you use Sherarduct Rigid Steel Conduit, your job will withstand the test of time.

EVERYTHING IN WIRING POINTS TO

National Electric Products

PITTSBURGH, PA.

3 Plants • 7 Warehouses • 42 Sales Offices



JANUARY at a Glance

The Outlook

Traditionally, each year, the editor assembles, from the quantities of statements and statistics which come in from many sources, an appraisal of the coming year. This we do with no claim to prescience. Fortunately there is a continuity to industry events. Outside of major economic changes or wars, statistical projections weighted by the significant trends of the times are an indication of what is to come.

So forecasting is actually a matter of judging the significance of past and present trends. And as we have to review in December what we said in indelible type last January, we are exposed to a harsh, but purifying and beneficial discipline. Outlook for '53 (page 81) is conservatively optimistic, but, we believe, a fairly accurate appraisal of the months ahead.

Cost Curve

With the help of the statistical resources of National Price Service of Cleveland, Ohio, the curve on this page will follow material cost movements in the months ahead. The values in the curve are derived from the cost of a "job mix" of materials. An approximately complete bill of materials from a typical job is priced, extended and totaled at contractor cost as of the first of each month. November, 1951 is selected as a base period and given an arbitrary index value of 1000. Subsequent monthly totals are charted in ratio to the base. This is an original contribution to the rather sparse basic statistics of the electrical construction industry. We hope to add, from time to time, other useful data from authoratative sources. Your suggestions as to the kind of data you would find most useful will be appreciated by the editors.

Code Problems

Your many comments about "Questions on the Code" and the volume of questions directed to our

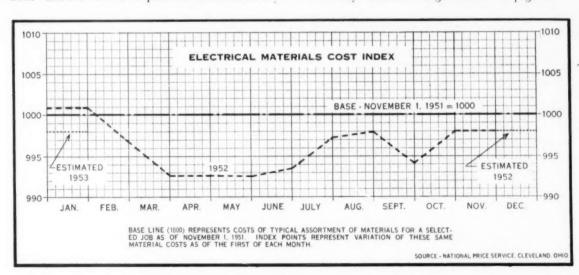
consultants are persistent testimony to the practical usefulness of our Code forum. Here thousands of readers who must apply the Code in letter and spirit to their daily tasks can follow the counsel of experts in the solution of practical problems of Code interpretation and application.

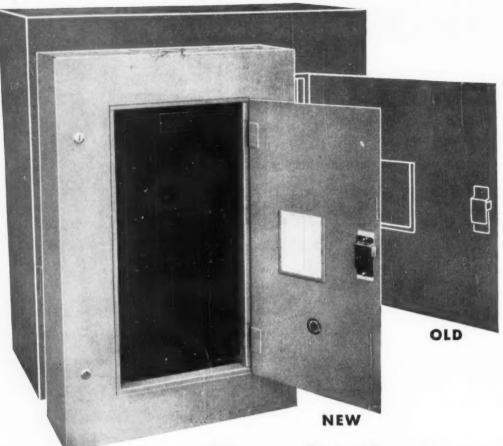
The answers given by our consultants are not "Official Interpretations." These are provided for in the administrative structure of the National Electrical Code and when issued formally become supplementary to the text of the Code. They are usually isued when a question arises which cannot be clearly answered or inferred from the official text.

But by far the greatest number of questions which arise in practical Code application can be answered directly from the text or by reasonable inference. Many problems are a matter of identifying or understanding the applicable provisions. Often, too, when the Code is clear, it is helpful to understand the history or intent of its provision. It is in these areas where expert guidance is particularly valuable even to those with a fully competent working knowledge of the Code and its application. So for practical Code discussion, be sure to follow the questions and answers in our monthly department, "Questions on the Code."

Outlets in Glass Houses

If the modern architectural trend toward a maximum of glass and a minimum of closed construction continues in apartment building—and even home—design, electrical contractors will find it increasingly difficult to install the necessary electrical outlets. Narrow two-inch partitions add to the headache. Reinke Electric Company in Chicago encountered these conditions in the wiring of Lake Shore Drive Apartments—Chicago's twin glass towers. To find how Reinke solved these problems turn to the picture-story "Outlets in Tight Places" on page 98.





More distribution capacity in less space

Here's a more compact Convertible Distribution Panelboard for 240-volt, a-c* applications, up to 600-amp capacity with main lugs, or 225-amp main breaker with branch circuit breakers up to 100 amperes, 1, 2 or 3 pole.

This new NDP Panel supplements the well-known Westinghouse Type CDP Convertible Distribution Panel. In a cabinet 20" wide, it is now possible to obtain circuit capacities for single phase as well as 3 phase and 3-phase 4-wire service, which formerly required the use of 30" wide cabinets.

Certainly this outstanding development points to savings in money, material and space. Take advantage of it now. Simply call your Westinghouse Representative or write for DB-30-930, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

J-93495

*-also 125/250 volt, 3-wire d-c systems

Westinghouse (



Optional Markets

IN OUR FORECAST for the year we are optimistic. The trends indicate good business volume ahead. Needs for the goods and services of the electrical construction industry were never more apparent. We are, on the whole, in robust good health and the public is enthusiastic about things electrical.

SO LONG AS CONSTRUCTION VOLUME holds and appliances sell we are assured of a substantial overall market. But a steadily growing portion of our market is optional. We can take it, or leave it alone. So can our customers.

QUESTIONS WE HEAR most about the coming year are very much concerned with the optional market. Adequate wiring, modern commercial lighting, industrial wiring system modernization, replacement of millions of dollars worth of antiquated and obsolete electrical apparatus that are out of place in our modern industrial and business economy all take selling. Will we find resources of initiative and sales energy to meet the apparent opportunities?

THERE ARE ENCOURAGING SIGNS. The new NECA business development program is one. A new commercial lighting program is in the making. Several other industry promotional programs will proceed on larger budgets than ever this year. From several independent industry sources we hear the same theme—this is the year to sell. So we can expect a lot more management interest in sales methods.

EVEN MORE ENCOURAGING is the growing awareness in our industry of individual responsibility for developing the market. A well informed, technically qualified and sales minded electrical contractor is a powerfully constructive force for industry progress. And today, more than ever before, he is an aggressive and articulate proponent for the development of electrical markets.

IN THE FUTURE COURSE of industry progress, the prosperity of any one segment is closely linked with the prosperity of all. Progress in load growth or major appliance sales, lighting or industrial control is dependent directly and indirectly upon the effectiveness with which the electrical construction industry operates. The interpretive engineering and the skilled technology of this industry is a basic ingredient of all electrical growth.

Um. T. Stuart



whatever the signaling need—you can get the proper equipment from your local Graybar office. Edwards Lokator code-paging or calling systems... Webster intercommunication systems... USI sound-powered telephones... fire

alarm systems ... plus bells, buzzers, horns, sirens, howlers — all are reliable products made by leading manufacturers. Call your near-by Graybar Representative for complete information on any item.

Help them TALK, WARN, CALL, LOCATE—at any point



PROVIDE FLICK-OF-A-SWITCH PAGING. An Edwards Lokator quickly locates personnel at any point throughout the plant. You can make installations using any type of signal equipment — horns, bells, buzzers, musical notes, or flashing lights.

Clear, fast plant-wide intercommunication speeds your customer's day-to-day operations . . . becomes absolutely vital during emergencies. But, before you buy equipment for your next communication job, check with Graybar to make sure you're getting the right choice of units for long-term service. Get the help of an experienced Graybar Signaling Specialist in planning the system best suited to the job requirements — a system that will save steps, save time, save money . . . perhaps even lives.

Because Graybar distributes a complete line of signaling equipment, you can get all of your needs from a single convenient source. Your purchasing problem is simplified ... you take full advantage of Graybar's nation-wide warehousing system ... you can be sure of prompt, on-schedule deliveries.

In addition, Graybar distributes everything electrical for wiring, lighting, power, and ventilation—over 100,000 items in all. Graybar Electric Co., Inc. Executive Offices: Graybar Building, New York 17, N. Y.

Call Graybar first for ...



Trends in '53

- Predicted construction is expected to run four percent above '52 with increases in residential and commercial, a decline in industrial new construction.
- Electrical work will total slightly above '52 to establish another record year.
- Shortage of copper will become less critical, but will continue to be a problem for several months.
- Controls may be continued longer than business has anticipated if military and economic conditions require them.
- Some price wars can happen, but costs and prices on the whole will probably advance moderately toward mid-year.
- Opportunities for substantial improvement in residential electric work, particularly lighting, and in commercial lighting modernization will reach new highs.

Outlook for '53

Continued high level of business, better material supply, full employment, more selling and a lot more concerns for market development are predicted for this year.

eneral business optimism is strong. The market areas of electrical construction look sound and full of opportunity for the year ahead. It should be a good year. But continued high volume and full employment often conceal weaknesses and perpetuate vices that a more rigorous business climate would expose.

Some statistical improvement in business volume in the coming 12 months is reasonably certain. Will the improvement be a complacent reflection of a generally prosperous economy or will it mark real and conscious industry growth?

The conscientious forecaster must be alert to the individual drives which contribute to the sum of industry achievement. The whole is equal to the sum of its parts—no more, no less. So each individual on every job has the power to modify or confound predictions of market potential not only for himself, but for his industry.

The electrical construction industry market is supported by a number of substantial props. Practically all new construction work requires electrical work which must come up to minimum accepted standards. This forms a very large assured market for the goods and services of the industry. Major appliance sales like ranges or dryers create a direct market for essential wiring. Utility load growth is reflected in added wiring to serve growing utilization.

Thus with predictions of new construction up 4%, appliance sales up 6% and load growth up 7% for the year the certain base of electrical construction must advance in proportion. In this area of its market the electrical construction industry can enjoy a virtually passive role.

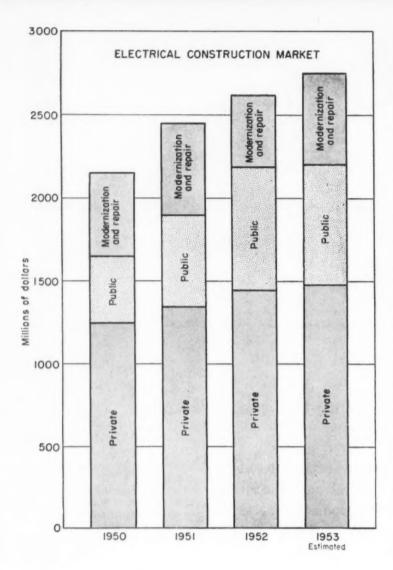
On top of its assured market, the industry has a vast optional market where individual and collective efforts move forward or backward to create or occasionally to destroy market opportunities.

In a new residence a minimum code job is assured, an adequate wiring job optional. With over 1,000,000 new homes predicted for the year, the enormous importance of the optional market is obvious. In school and office lighting 30 foot candles is assured with the optional area more than twice as much. The optional market cannot be developed or maintained by a passive industry, but must be deliberately cultivated.

New Construction

This year there are already significant signs of a more aggressive concern for market development. The new N.E.C.A. business development program for electrical contractors is the most spectacular. A N.E.M.A. program for commercial lighting promotion is in the making. Budgets for most industry promotion activities are generally higher.

New construction activity in 1953 is expected to reach a new peak, perhaps rising about \$1 billion over the \$32\frac{1}{2}



billion apparent for 1952, according to outlook estimates prepared jointly by the U. S. Labor Department's Bureau of Labor Statistics and the Building Materials Division of the U. S. Department of Commerce. Some expansion is likely in the coming year in both private and public construction.

The outlook for record construction activity in 1953 assumes that business will remain good, buoyed in part by increasing defense expenditures, at least in the early part of the year. Barring major international developments in 1953, it was assumed also that materials would be plentiful, that the limited controls in force would not interrupt construction operations, that the labor supply would be adequate, and that costs would remain relatively stable.

A peak of \$22.2 billion in 1953 ex-

penditures for new private construction is anticipated, supported by a continuing high level of housing activity and expansion in public utility plant and commercial building.

About as many private dwelling units are expected to be started next year as in 1952, when the million-unit mark will again be exceeded. Expenditures for new private housing actually put in place, however, at \$10.2 billion, will be somewhat greater than in 1952, because next year will begin with a larger number of units already under way, as the unseasonally large numbers of dwellings begun this fall are completed. Prediction of an active homebuilding year is based primarily on the anticipated favorable economic climate and ready availability of mortgage funds.

Next year is expected to be the tenth in succession of increasing construction activity by the public utilities. Announced expansion goals suggest unprecedented expenditures of about \$4\frac{1}{2}\$ billion in 1953. Most of the 11-percent rise in volume over 1952 will occur in the gas and electric light and power group for which an extensive backlog of both industrial and domestic need exists.

Commercial building activity will probably jump by over a fourth in 1953, continuing the recovery evident in recent months as a result of improved materials availability and removal of credit controls. On the other hand, private industrial building is expected to drop by about the same proportion, from this year's record outlay of about \$2\frac{1}{2}\$ billion, as defense plant expansion programs approach completion.

Although 1953 will be another active defense year, the anticipated rise in total public expenditures for new construction, from \$10.6 to \$11.3 billion. is expected to result as much from increasing activity on civilian as on military types of public work. Highway construction will probably reach a new high of \$3 billion next year, or nearly 10 percent above this year's level, reflecting the expanding program of Federal aid to highway building, and an anticipated large volume of State tollroad construction. Ground has already been broken for the \$300 million Ohio Turnpike project, and work is proceeding rapidly on the \$500 million New York State Thruway.

Public school building will continue its postwar expansion into 1953 responding to constantly growing classroom needs. Expected expenditures for schools of about \$1.8 billion represents a 10 percent increase over the 1952 total, and the largest amount of classroom space ever to be put in place in a single year.

On the military side, outlays for military and naval facilities will probably rise around a fifth to about \$1.6 billion, as considerable new work gets under way, much of it already under contract, and the extensive current program is completed. A much more moderate rise (3 percent) will occur in public industrial construction resulting entirely from additions to existing atomic energy facilities and commencement of the huge atomic plant near Portsmouth, Ohio. Industrial facilities construction for the Army, Navy, and Air Force, mostly the rehabilitation of existing ordnance plants, will be substantially completed during 1953.

Public residential building will drop from last year's level, reflecting the tightened statutory limitation on the start of new Federally subsidized housing units. Virtual completion of the Veterans Administration program of hospital construction and reduced funds for the program of Federal aid to State and local hospitals will cause a substantial decline in the rate of publicly aided hospital building.

A factor not usually recognized in forecasts is work deferred by temporary local distortions of the normal building economy. This backlog may begin to come into the market this year with the completion of some major mobilization projects. Very large jobs tend to soak up available manpower, distort traditional local values and discourage other work.

Power

An adequate supply of power was available in all sections of the United States throughout the year 1952, with two exceptions. In the Pacific Northwest drought was experienced in the latter part of the year. The Bonneville Power Administration of the Federal Government in that region operates under a "calculated risk" policy whereby it contracts to sell power to large industries beyond the firm generating capacity of its hydroelectric plants in dry years, a policy which contemplates the risk of periodic power shortages. In the Tennessee Valley area, drought also resulted in some interruption of power supply to those industrial customers holding interruptible power contracts.

The gross margin between generating capability and peak power demand in 1952 for the country as a whole was about 12 percent. Shortage of critical materials, aggravated by the steel strike in mid-summer held back the construction program of the power industry and is expected to continue to affect adversely construction progress in 1953 and 1954. Schedules which called for an addition of 9 million kilowatts of generating capacity in 1952 experienced a slippage of nearly 3 million kilowatts, almost one-third. The actual addition of new capacity was a little over 6 million kilowatts. The causes of delay, however, held back about equally the operations of power consumers so that the anticipated growth of power demand fell short of expectations, leaving the margin between total generating capability and total peak demand unchanged from the total of the year

The growth in December peak demand for 1952 was about 7 percent compared with a growth of 9 percent in 1951, and in 1950, following the

ELECTRICAL WORK

(Millions of Dollars)

NEW CONSTRUCTION Private	1950	1951	1952	Projected 1953
Residential	616	535	554	584
Farm	47	56	68	68
Industrial	100	236	275	198
Commercial	232	247	265	295
Utilities	240	280	294	326
Other	7	4	8	10
Total Private Funds	1242	1358	1464	1481
Public				
Residential	35	60	32	29
Industrial	45	110	197	204
Educational	105	117	194	213
Hospitals & Institutions	34	39	57	45
Other Non-Residential	31	35	29	32
Military	5	35	68	80
All Other	150	140	140	120
Total Public Funds	405	536	717	723
Total	1647	1894	2181	2204
MODERNIZATION & REF	PAIRS			
Service Replacement	85	100	60	78
Appliance Circuits	65	82	41	65
Rewiring	120	160	130	150
Relighting	190	150	125	180
Repairs & Replacements	50	69	70	75
Total	510	561	426	548
Total All	2157	2455	2607	2752

outbreak of the Korean War, an increase of 14 percent over the previous year.

Total installed generating capability at the end of 1952 was approximately 84.5 million kilowatts. The margin between peak demand and generating capability was about 9 million kilowatts.

The construction program for the entire power industry for 1953 calls for the addition of 12 million kilowatts. Delays in construction schedules are expected to continue, however, because of the effect which shortages of critical materials have already had and will continue to have on the manufacture and installation of heavy power equipment.

The investor-owned companies have scheduled the installation of about 9 million of the 12 million kilowatts scheduled for installation in 1953.

Total construction expenditures

from the end of World War II to the end of 1952 amount approximately to \$13 billion, a figure greater than the total investment of the power companies in electric plant and equipment of \$12½ billion at the close of 1945.

Electricity generation by the industry increased 27 billion kilowatt-hours over 1951 to attain a record of about 400 billion kilowatthours. With the addition of some 63 billion kilowatthours generated by industrial and railway plants for their own use, total U. S. electricity production in 1952 was about 463 billion kilowatthours.

Over 1½ million new customers came on electric lines during 1952, bringing the total to about 48½ million. This increase represents an expected leveling-off from the phenomenal rate of growth, averaging better than 2 million customers a year, experienced since World War 11. Because elec-

tricity now reaches nearly every American, with more than 97 percent of all occupied urban and rural homes being served, future customer additions will largely reflect the formation of new households.

Electricity use continued its accelerating advance in the home during 1952, with the average annual consumption per residential customer rising to 2175 kilowatthours, the second straight year in which the average use increased by more than 170 kilowatthours. Average revenue per residential kilowatthour reached a new low of 2.76 cents.

Will Controls Be Continued?

There has been increasing pressure over the past several months to revoke or to drastically curtail and relax all mobilization and economic controls imposed on business and the economy by the Truman Administration under the terms of the Defense Production Act of 1950. The major criticism has been directed against the unpopular and highly debatable price and wage ceilings set up as a hedge against inflation.

This pressure has come from various industry and trade groups, and from business men generally. They object basically to direct governmental control of industry and commerce, except in times of dire national emergency. While they accepted these controls in 1950 and 1951 as urgently needed to meet a national emergency. they argued in 1952 that the need for such direct controls no longer existed. Productive capacity had expanded, military and arms production spending had been stretched out, and the supply and demand of goods had reached an approximate balance, they contended. But the Truman Administration consistently resisted this pressure and doggedly maintained the entire DP Act controls framework, and most of the controls, even after the Presidential election last November resulted in a change of administration. Finally, after the election, Truman and his mobilization chiefs decided to stand pat and to retain all economic and materials controls then existing until the Republican Administration takes over January 20, 1953. Thus the ultimate decision on whether to retain or abandon these controls will be up to Eisenhower and his incoming Administration after inauguration.

Facing Eisenhower and his newly appointed leaders after January 20 will be two major questions on controls. First will be whether there is a need for them; and second, what type of

controls will be most effective, if it is decided that they are still necessary.

Whether or not controls will be needed will depend largely on President Eisenhower's policies on Korea, military build-up, arms production, foreign military and economic aid, and mobilization stretchout, plus the estimated continued status of our domestic economy. While many leaders in the new Administration have urged elimination or drastic curtailment of practically all controls, most Congressmen are now inclined to caution. The earlier clamor for decontrol had all but ended by the first of the year. It had been accepted that any step-up in military activity or speed-up in defense mobilization and spending might well dictate the retention of controls in some form, at least on a standby basis.

Price-Wage Controls

Under the terms of the DP Act of 1950 as amended last mid-year by the 82nd Congress, price-wage controls are already scheduled to expire April 30 this year. The Truman Administration placed its principal reliance on such direct controls as price and wage ceilings, to check the steady rise in prices and living costs. The 82nd Congress extended these controls through the first quarter of 1953 only, after long and heated debate just prior to its closing days last Summer. So when Eisenhower takes office January 20, the existing inflation controls will expire automatically in about fourteen weeks, unless he takes some action to have them retained.

It is expected that Eisenhower's program to curb inflation will differ sharply from that of the Truman Administration. It will probably be based on the use of indirect controls to regulate the supply of money and credit, as contrasted with Truman's principal reliance on direct controls. Since it has been difficult and costly to administer and enforce either price ceilings or wage ceilings, it is expected that Eisenhower will either revoke these controls immediately upon taking office, or let them run their short course through April 30 while the new 83rd Congress has an opportunity to study his proposed indirect controls program and the need for it. Adherents of decontrol will no doubt urge immediate revocation, which would eliminate the problem of appointing new administrators and trying to maintain these unpopular direct controls. But the final decision will be influenced by Eisenhower's broad programs with respect to Korea, military spending, continuation of plant expansion, and other economic factors which affect inflation, and the period of time required to put his indirect controls program into effect.

Controls of inflation through regulation of the supply of money and credit will be manipulated by the sale or purchase of Government bonds by the Federal Reserve System, if Eisenhower's indirect control program to curb inflation is adopted. When prices rise too rapidly, FRB will sell bonds which it holds, thereby reducing the volume of money or credit that banks or individuals can use to make loans. Likewise, when prices are sagging and business activity is being slowed down, the process is reversed. The FRB will buy Government bonds, even if it has to pay a premium to do so. Its payments for the bonds will increase the amount of cash or demand deposits in the banking system available for loans to business

The policy of regulating prices by controlling the amount of money in circulation depends on a balanced budget. This is Eisenhower's stated goal. So it is expected that the price-wage formula followed by the Truman Administration will be scrapped soon after Eisenhower's inauguration, or at least be permitted to die automatically April 30th.

Materials Controls

The National Production Authority, charged with the responsibility of seeing that producers of military and defense supporting products obtain adequate metals and materials to fill their rated orders, had alloted materials to all producers through the second quarter of 1953 at the turn of the year. Under the terms of the DP Act of 1950, as amended by the 82nd Congress, materials controls are extended to June 30, 1953.

The NPA, staffed by qualified industry specialists, has been less subject to criticism by industry than other defense agencies. It has worked in close contact with industry, through its Industry Advisory Committees, thus maintaining an up-to-date viewpoint on the materials and supply problems faced by producers. As a result, controls orders and regulations have been issued, amended, and revoked as often as necessary to insure equitable distribution of available metals and materials among the various manufacturers according to the urgency of the products to the defense effort, all with a minimum of disruptive controls where not needed.

As of January 1 NPA had already

cased controls on new building construction, and on steel and copper. But NPA officials believed it would be a grave mistake to scrap materials controls until the new Administration's mobilization program has been fully outlined. They predict a need for metals controls even beyond July 1, to insure metals requirements for the military, Atomic Energy Commission, and the expansion programs of the petroleum, electric power and transport industries which have not yet been completed.

The greatest pressure for materials decontrol has come from the building industry. Under this pressure NPA has eased all of its curbs on steel and copper in building construction by establishing self-authorization procedures for these metals in limited amounts of various classifications of buildings. Because of a temporary shortage of primary aluminum caused by the power shortage in the Northwest last fall, less relaxation of curbs on this metal has been made. Relaxations put into effect January 1 had been set originally for May 1, but continued record output of steel, and the availability of slightly more copper seemed to warrant the relaxation.

It is now predicted that NPA will retain its Controlled Materials Plan and its implementing regulations until June 30. Many producers, especially those in the smaller industries, have recommended that CMP be retained as long as possible. It assures them their modest metals requirements and permits them to schedule production without serious interruptions, they point out. And producers of any products, military or civilian, which use metals or materials still in short supply (for example-nickel, cobalt, selenium, etc.) want CMP retained so long as these materials remain critically short.

There is discussion of "open-ending" CMP, which would permit NPA to allocate metals for arms and atomic energy programs, then allow surpluses to be purchased without CMP tickets.

Opportunity

Several market areas are under close industry observation this year because they appear to be ripe for a major change.

Residential lighting with built-in or built-on fixture has passed through an absurd low where such fixtures were almost completely eliminated from new construction. The pendulum is now swinging back. The impact of industry promotion, new and modern fixture design and increasingly favorable pub-

ESTIMATED NEW CONSTRUCTION ACTIVITY, CONTINENTAL UNITED STATES 1952-1953

(Millions of Dollars)

	1952		rcent Change 1953 from 1952
Total New Construction	32,318	33,500	+4
Private Total	21,681	22,200	+ 2
Residential (excluding farm)	11,029	11,450	+ 4
New dwelling units	9,820	10,200	+ 4
Additions and alterations	1,026	1,050	+ 2
Nonhousekeeping	183	200	+ 9
Nonresidential building	4,945	4,600	- 7
Industrial	2,289	1,650	-28
Warehouses, office and loft bldgs.	479	575	+-20
Stores, restaurants and garages	622	825	+33
Other nonresidential building	1,555	1,550	
Religious	397	425	+ 7
Educational	354	375	+ 6
Hospital and institutional	388	350	-10
Social and recreational	125	150	+20
Miscellaneous	291	250	-14
Farm construction	1,700	1,700	0
Public utility	3,925	4,350	+11
Railroad	400	425	+ 6
Telephone and telegraph	550	575	+ 5
Other public utility	2,975	3,350	+13
All other private	82	100	+-22
Public total	10,637	11,300	+ 6
Residential	643	575	+11
Nonresidential building	4,104	4,250	+ 4
Industrial	1,649	1,700	+ 3
Educational	1,618	1,775	+10
Hospital and institutional	478	375	+22
Other nonresidential building	359	400	+11
Military and Naval	1,355	1,600	+18
Highway	2,740	3,000	+ 9
Sewer and water	686	725	+ 6
Miscellaneous public service enterpris	ies 202	200	- 1
Conservation and development	843	875	+4
All other public	64	75	+17

lic reaction to recessed units and concealed sources are catching on.

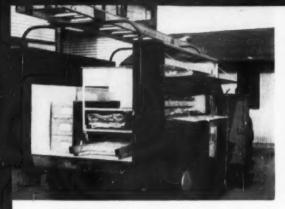
Air conditioning, from room coolers up, is moving at a phenominal pace. Practically all such equipment requires special wiring. Some new units include electric heat for year round use.

Electric heating, from supplementary to complete space heating, is forging ahead in spite of high operating costs as compared with fuel burning systems.

Lighting in stores and offices may be entering a new phase. Successful installations providing in excess of 100

footcandles with effective control of brightness contrasts are appearing. The results are so spectacular that widely accepted standards of "modern" lighting may already be obsolete.

In summary, 1953 offers a good volume outlook. There is hard selling ahead, however, if the industry is to expand its share of the economy. Fortunately times are prosperous and the public is well disposed toward the production and services of the electrical industry. There is some shortage of some materials, but no shortage of opportunity.



SPECIAL BODY \mathcal{V}_2 -ton maintenance trucks which carry complete stocks of replacement parts plus special tools and equipment are used.



OLD LAMPS are disposed of by feeding them into a Ludaby lamp chopper, whose waste container will hold 300 broken-up fluorescent lamps. Chopper is kept in the combination work shop-stock room.

LIGHTING MAINTENANCE—A Profitable



How lighting maintenance service can develop plus-business and add more profit for electrical contractors, and how Cleveland's largest lighting maintenance service company operates successfully, is explained by the owner . . .

Edward I. Creed* C & S Lighting Maintenance Co.

PLANNED lighting maintenance is by now an old subject with most electrical contractors. Many have even suggested to their customers that they follow a planned lighting maintenance program. But how many contractors realize how a planned lighting maintenance program will save their customers money, and yet be a real profit builder for them?

Here is the story of how C & S Lighting Maintenance Company's business was developed from opportunities which electrical contractors overlooked. Based on these facts, electrical contractors can analyze their own organization and customers with the idea of making extra sales.

Need for Lighting Maintenance

It is difficult to prove, from a purely accounting view, that dirty fixtures

and blackened and burned out lamps result in the increased cost of a product or of service. On the same basis it is hard to show that the costs of sweeping the floors and washing the windows lowers the cost of a product. Yet there can be no doubt that a good lighting system, properly maintained, will have a beneficial effect upon efficiency and appearance when compared with a lighting installation that has been neglected.

Planned lighting maintenance as opposed to neglect of a lighting system has the following advantages: (a) reduction of accidents; (b) improved quality of work; (c) fewer mistakes and rejects; (d) increased efficiency; (e) improved inspection; (f) improved employee morale; and (g) improved appearance.

Hidden intangible losses are almost impossible to show in a financial statement. Yet there is a great waste of capital investment in lighting systems due to lack of adequate maintenance. These are the proven facts: (a) worn out lamps lose their efficiency; (b) lamp burnouts are a factor in light depreciation; (c) dirt and dust rob the customer of light for which he is paying; (d) there is a depreciation of the lighting investment due to the lack of adequate maintenance; and (e) electrical energy is wasted due to lack of adequate maintenance.

Failure to follow through on planned lighting maintenance nullifies the large investment in lighting equipment which was intended to provide high levels of illumination. It also results in firms with poorly maintained lighting systems having to pay out sizeable amounts each month for electrical energy which is wasted because it produces no light. Planned lighting maintenance will eliminate this financial waste, and this is the main reason for having it.

Planned Lighting Maintenance

What is planned lighting maintenance? It is merely the following of preventive measures to keep a light-

^{*} This article is based on two talks by Mr. Creed before Electrical Contractor's Conference held at the General Electric Lighting Institute, Nela Park, Cleveland, on September 22, 1952 and October 28, 1952.



MOBILE TELEPHONES in service trucks permit efficient and prompt dispatching, save time, and are a good selling point with new customers.



CLEANING TANKS are portable, and of custom design. Each tank combines calrod-heated wash and rinse tanks and drain rack.

Market for Electrical Contractors

ing system operating at top efficiency. There are eight such measures which are of primary importance.

1. Take light meter readings periodically. The factors which cause the need of a maintenance program produce a slow steady decline in light which is not noticeable to the human eye, so a mechanical measurement is necessary.

2. Establish a satisfactory and economical plan for lamp replacement. This will probably mean group replacement, since this plan makes fewer work interruptions, eliminates many maintenance headaches, improves the appearance of the installation, and produces more light. The savings in labor cost under a group replacement plan will more than pay for the unused value of old discarded lamps.

3. Establish a regular schedule for cleaning lamps and fixtures as determined by light meter readings. Dirt and dust can reduce light output by 50% in a comparatively short time. The time between cleaning intervals should be determined by the rate of dust accumulation, and the practical economies of scheduling workmen's visits to the iob.

4. Keep a stock of spare parts. Light output may be impaired by the failure of any part of the lighting system. Therefore, an adequate stock of sockets, lamps, starters, ballasts and the like, should be available at all times.

5. Make periodic voltage checks. Both incandescent and fluorescent lamps are designed to give a rated output at a specific voltage. Therefore, to get the most light output, lamps or ballasts designed for their specific line

voltage should be specified. Then that voltage should be checked regularly to see that it stays within the specified limits

6. Clean or repaint all reflective surfaces when warranted. The color of the walls, ceilings, floors, and machines affects the efficiency of any lighting installation. Dirty or dark reflective surfaces can absorb as much as 90% of the light which strikes them. Clean, light-colored surfaces can reflect as much as 90% of the light.

7. Use special devices to cut maintenance costs and simplify operations. Many devices have been designed to simplify maintenance problems. Some of these are: special ladders, telescoping platforms, mobile platforms, portable scaffolds, relamping bridges, disconnecting hangers, and cat-walks or trusses. It is best to use only those devices suited to particular operations and type of building construction. Obviously, they should provide for the safety of the operators, be easily maneuverable, and in certain cases enable maintenance crews to work without interfering with operations below.

8. Make electrical repairs immediately when needed. Electrical faults are a minor, but very important, phase of lighting maintenance.

All of these measures combined equal planned lighting maintenance, which is preventive maintenance at its best.

Lighting Maintenance Service

Lighting maintenance service is positive action offered to maintain the intended level of illumination—it is not just another janitorial service!

The C & S Lighting Maintenance Company offers just a lighting maintenance service in the Cleveland area, logically strengthened by lamp selling. All my comments are based on our own operations. We are not an electrical construction company. We do lighting maintenance service work only. We have our own salesmen, electrical repairmen and cleaning crews. I am charged with overall responsibility and operation. More specifically, I concentrate on making new contacts and supervising the sales promotion work.

Every member of our company is a salesman, although certain men have the additional responsibility of locating new customers and selling "good lighting" maintenance contacts. These salesmen know as much about the complete operation of the company as anyone. They have an electrical background; they know company policy, prices on lamps and fixtures, scheduling, man hours, and equipment. They also know as much about selling light as the contractor who installs lighting systems. Our salesmen are the contact men who keep the customer happy after the contract is signed.

In looking for new customers, our salesmen use the "block" system to locate possible contacts. Regular customers are first located on the city map and then, using the city directory as a guide, businesses in the surrounding neighborhoods are contacted. This methodical search tends to eliminate the possibility of overlooking likely prospects and helps to reduce travel time of cleaning crews. In addition we use direct mail, taking advantage

of promotional material and selling aids available from lamp and lighting equipment manufacturers.

Our electrical servicemen are all experienced personnel who are trouble shooters in addition to being supervisors. They know all electrical circuits and particularly fluorescent ones. They schedule cleaning jobs, supervise cleaning crews, check footcandle readings before and after cleaning, make monthly service checks, make minor repairs or tag defective parts for repair. In addition they handle customer reports, time sheets, and do shop repair work. Since they are supervisors and have direct contact with our customers, we require them to be neat, clean and courteous.

We use two-man cleaning crews because we have found them to be the most efficient. These men are required to be neat. They are men who have finger dexterity and physical stamina. They have uniforms for morale, identification and advertisement. They are able to disassemble and assemble any type of fixture, change lamps and starters, and they follow a definite procedure which is the most efficient cleaning method.

Maintenance Equipment

We use special maintenance equipment wherever we can. Trucks are one of our most important pieces of equipment. We use \(\frac{1}{2}\)-ton, special body trucks, which have storage space for cleaning tanks, scaffolding and ladders, plus additional compartments for lamps, starters, ballasts, hand tools and the like. Each truck carries a complete stock of material for servicing the accounts on which it is used. We have found it profitable to install mobile telephones in some of our vehicles and it is a great time saver plus being a good selling point.

There are many different kinds of scaffolding available and different kinds of businesses may require different kinds of scaffolds. We use a Baker and Roos (Indianapolis, Indiana) unitized steel scaffold consisting of ladder ends and support trusses, plus a platform. These 6 ft. by 6 ft. by 29½ in. sections can be used either individually or together, depending upon the floor situation.

Ladders give us no trouble at all. We have light-weight metal ladders fitted with rubber shoes to prevent slipping and to insulate from the ground.

Cleaning tanks did present a problem as we were unable to locate any good ones on the market. Our firm uses a portable wash and rinse tank designed by Carl J. Allen, General Electric Company, Nela Park. This unit combines the washing, rinsing and drying operations. It contains calrod heating units for the washing solution, and rinsing tanks. The drain racks are just above the rinse tank. It is easily maneuverable and its use has cut many hours from the usual washing and drying operation.

The amounts and kinds of supplies needed is dictated by experience and types of accounts serviced. Our trucks carry standard packages of each type of lamp holder and socket under contract. They carry at least 3 boxes of each type of starter, 4 boxes of each type of starter, 4 boxes of each type of ballast, in addition to fixture wire, soldering irons and solder, tape and hand tools. Our warehouse keeps a full month's supply of all items to back up our trucks.

We use "Once Over" detergent in our washing operation. We have found that the use of this detergent, plus the use of the special wash and rinse tank has cut the time of some cleaning operations in half.

A good approach to the cleaning cloth problem is to obtain worn-out diapers from a local diaper service. These, plus good chamois and sponges, should solve this problem.

Almost all of our work is done by contracts and I feel that this is the most satisfactory arrangement. Our contracts are flexible enough to cover almost any type of job and yet they don't protect us so completely that customers won't buy our services.

Records and office forms can be the bane of a business or they can be used to eliminate guess work and intuition, help establish prices and justify expenses. I use exactly 10 different office and operating forms to help analyze costs, profit, and loss and to show where we can improve our service and cut expenses.

Lamp disposal has often been a problem and particularly so with fluorescent lamps. We use an efficient lamp chopper produced by the Ludaby Company of New England. Fluorescent lamps are merely fed into the tube, and they are chopped. This small machine will dispose of approximately 300 fluorescent lamps before the waste container needs to be emptied.

Advertising Media

The established electrical contractor knows the value of good advertising. He already has his list of satisfied customers, and this list should be the basis of his advertising plan. But the best advertising for a service organization is good service. I firmly believe

this because it is a policy that has been profitable for me. I have also found out that direct mail advertising has worked out next best for us. Our mailing list was compiled over a period of several years. We have also found out through experience that a sustained advertising program produces best results. Our promotional literature is usually in the form of personal letters, supplemented by various types of manufacturers' literature.

No amount of advertising will produce signed contracts. Only a salesman following up advertising leads will be able to do this.

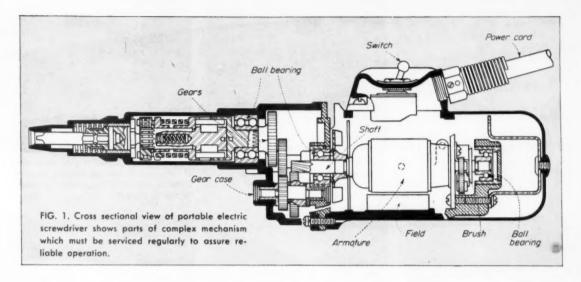
Ready Market for Contractors

The most logical person to be getting lighting maintenance service contracts is the electrical contractor. After all, who should know the most about a lighting installation? The contractor who installs it-naturally. Most electrical contractors overlook or neglect this very lucrative service. Yet the operation of a lighting maintenance service is relatively simple, and what is more important is that there is need for such a service wherever there is lighting. And the established electrical contractor already has most of the equipment he needs for this maintenance work.

The responsibility of the electrical contractor should not end with the setting up and installing of a lighting system. He should offer a service which will help his customers maintain their intended levels of illumination, help to maintain the appearance of their installation, and help keep maintenance costs down. He should acquaint his customers with the fact that outages, lamp depreciation, low voltage, dirt and dust collection on lamps, luminaires and reflective surfaces (i.e., reflectors, walls, etc.) all contribute to lowering the level of illumination for which they have paid. He should explain to his customers that their lighting system must be paid for whether or not it is used; that some lamps should be removed before they burn out; that dirty and dusty lamps and fixtures waste dollars -not pennies; and that there is a most economical time for cleaning fixtures.

By selling his customers on planned lighting maintenance, and by offering a lighting maintenance service, the electrical contractor can develop "plus" business from these same customers. Lighting maintenance service is a profit builder that will help the contractor get an "exclusive" on many new jobs. It can be one of his best

(Continued on page 215)



Maintenance of

Portable Electric Tools

Assure long life and reliable operation of 110- and 220-volt 60-cycle portable electric tools by—

- 1. Setting-up a program for their economical maintenance, and
- 2. Inspecting and servicing them on a regular schedule.

By Walter J. Prise

Chief Engineer, The Maintenance Company, New York, N. Y.

ETTING the most out of portable electric tools depends upon planned preventive maintenance. A well-rounded program for selecting, handling and servicing these tools is the one sure way to keep them in top operating condition and to minimize the possibility of major breakdowns.

In setting-up this program, sound planning is necessary to assure economical maintenance. Electrically-driven drills, grinders, screwdrivers, hammers and chisels, in themselves, present an unusual maintenance problem. Because these tools are relatively low in purchase cost, servicing and repair of them can cost more than the tools themselves if not properly organized and evaluated in detail. But, taken together, the tools do represent

a considerable investment which demands the protection of a maintenance program. Further, such tools are important time- and labor-saving devices, and breakdown on construction jobs far away from the "home base" often leads to serious slowdown or complete interruption of a job, with a consequent increase in cost of production. For these reasons, maintenance of portable electric tools must be planned, economical and preventive.

Program

Planning for the right kind of an electrical tool maintenance program should be aimed at assuring long life and reliable operation of each tool. Planning must include consideration of all of the factors which are in any

way concerned with keeping tools in service and preventing breakdowns. Careful attention should be given to each of the following details:

TOOL SELECTION—Each type of portable electric tool should be selected with a clear understanding of its purpose and capability. Considering the type of duty it will see and the amount of use it will get, each tool should be selected on the basis of its operating characteristics and any special features which might particularly suit it to a given set of operating conditions. A particular size should be chosen to handle the majority of jobs.

TOOL MAKE—As much as possible, tools should be standardized as to their make. Using only one or two

Take These Steps In Servicing Portable Electric Tools



FIG. 2. Visually inspect outside of tool and power cord for obvious defects such as torn insulation on power cord, usually at either end.



FIG. 3. Remove screw cap on each side of housing to get at motor brushes. Brushes are held in position in hole by spring pressure.



FIG. 7. Remove the armature from the motor and inspect for apparent defects on the armature and on the stator.



FIG. 8. Check the bearing on the end of the armature shaft for wear and poor fit. Replace bearing if it has play.



FIG. 9. Open gear case and check condition of the gears and the lubrication. Examine gear teeth and the mesh.

particular makes of electric tools greatly facilitates maintenance. Replacement parts can be stocked more easily; servicing procedures can be standardized; and a better understanding of tool operation can be developed.

TOOL USE—Definite steps should be taken to make certain that tools are used properly. Half the maintenance battle is won if improper use, abuse and overloading of tools can be eliminated. All mechanics should be instructed in the proper use of each type of tool and informed of the limitations of each. A firm policy should be established on this point, and constant reminders should be circulated among personnel to instill high regard for tools and their proper use.

SPARE PARTS—Based on experience and knowledge of each tool's operating mechanism, thorough analysis should be made of the need for renewal and spare parts. An adequate supply of each of the necessary parts should be stocked, with someone assigned to maintain the parts supply.

INSPECTION—A schedule should be set-up for regular periodic inspection of tools by a qualified mechanic. This schedule can be based on a certain number of tool working hours or on regular intervals of so many months. If working conditions permit, it is often advisable to establish, in addition to the regular inspection, testing of all tools when they are returned to the shop. Such a procedure will guarantee that all tools issued by the shop are in good working condition.

SERVICING — Plans should be made for servicing tools at the time of inspections. A man should be put in charge of servicing and trained in the job. Servicing should consist of lubrication, routine replacement of worn or defective parts and minor repairs which can be handled economically. As part of the plans for servicing, investigation should be made of the programs which manufacturers have instituted for replacing some of the larger tool components which are often expensive to repair.

REPAIRS—Although minor repairs are taken care of as part of the servicing operation, it is usually more economical to have major tool repairs handled by an accredited motor repair organization. Such organizations are capable of extensive repairs at a cost below that of replacing the tool. Some organizations actually specialize in this type of repair. Names of reputable

shops and their price lists should be kept readily available.

Servicing

Depending upon the schedule for periodic inspection, all portable electric tools should be thoroughly checked for defects and given whatever reconditioning is necessary to restore them to top operating shape. Inasmuch as most electric tools operate on the same principle, with variations only in the mechanical transmission of the motor output, servicing procedure can be fairly standard for all tools. It should, however, be as complete as possible to be effective. Portable electric tools are rather complex mechanisms with hundreds of mechanical and electrical parts which are mutually dependent on each other for proper operation. (Fig. 1) To reduce the likelihood of trouble developing. regular checks should be made on as many of these parts as possible.

A typical servicing sequence is that on a 1-inch electric drill, as follows:

A. Inspect outside of tool and the power cord. (Fig. 2) This often can reveal actual or approaching trouble, such as broken parts or defective power cord due to torn or frayed insulation.



FIG. 4. Remove the brush from each side of the housing and check both brushes for wear and for broken or weak springs.



FIG. 5. Stand tool on back end and remove screws which hold the working end of the tool to the motor housing end.



FIG. 6. Separate the working end from the motor end by carefully disengaging the gear on the end of the shaft from the gear case.



FIG. 10. When necessary, clean gear case and replace fresh grease in accordance with manufacturerer's instructions.



FIG. 11. Clean and grease the bearing which bears the armature shaft through the back plate of the gear case.



FIG. 12. Stock or have available the most important renewal parts—the armature, bearings, brushes and switch.

The power cord usually receives rough treatment due to mechanical wear, exposure to the elements and other abuses. Troubles most often develop either at the receptacle end or at the point at which the cord enters the housing. If insulation is defective, a cord should be replaced or repaired.

B. Remove screw cap on side of housing to get at motor brushes. (Fig. 3)

C. Remove the brush from each side of the housing and check condition of both brushes. (Fig. 4) Brushes are the least expensive of the tool's operating parts, and should be replaced when more than half of the brush body is worn away. Failure to replace brushes in time usually results in poor contact, pitting and burning of the commutator, and may lead to serious damage to the armature, the most expensive part of the tool. Check for broken brush springs, and make sure that new brushes seat properly to the curvature of the commutator.

D. Stand tool on its back end and remove screws holding the "business end" of the tool to the motor housing. (Fig. 5)

E. Carefully pull the working end of the tool straight away from the

motor end, disengaging the gear on the end of the armature shaft from the gear case. (Fig. 6) Check for wear or defect of the gear on the shaft.

F. Remove the armature from the motor and inspect for apparent defects on the armature and on the stator. (Fig. 7) Particularly look for evidence of rubbing between the armature and the stator pole pieces. Check the armature circulating fan and the commutator. Carbon deposit can be wiped from the commutator with canvas cloth. Remove shorts and open spots, and correct flat spots.

G. Check for worn or poor fitting bearing on the armature shaft. (Fig. 8) Bearings are particularly vulnerable parts of electric tools. See that sufficient lubricant is present, that dry wicks are replaced with new ones, and that enough grease is packed in space provided. Worn bearings can be detected by loose fit of the shaft and by noisy vibrating armature. Bearings must never be allowed to wear until clearance between armature and fields disappears.

H. Open gear case and check condition of the gears and the lubrication. (Fig. 9) Examine gear teeth and the mesh. From the manufacturer's in-

structions, determine if the lubrication is excessive, inadequate or dirty.

I. In accordance with the manufacturer's instructions, clean gear case when necessary, and replace fresh grease of the proper type. (Fig. 10)

J. Grease the bearing in the back plate of the gear case. (Fig. 11)

In checking the various parts of any portable electric tool, particular emphasis should be given to those parts which most frequently give trouble. Usually, those parts are the armature, bearings, brushes and the switch. (Fig. 12) Due to continuous and frequent use, the switch is particularly susceptible to troubles arising from poor connections and pitting and wear of the contacts. In most cases. repair of a switch is not worthwhile; replacement is the recommended procedure. Another frequent source of trouble is faulty operation of any of the springs used in electric tools, especially those in tension controlled tools. Springs should be checked; and if there is evidence of improper spring reaction or of fatigue in the metal, a spring should be replaced.

Maintenance of portable electric tools can be made a worthwhile, profitable endeavor.

REPLACING a Hot Switchboard

Old, hazardous switchboard in New York State Capitol was replaced, and old feeders were traced and rerouted without interrupting continuity of electrical service to State Police communications nerve center. This tough assignment was effectively handled by Electrical Contractor E. G. May.

By Hugh P. Scott

NE of the toughest switchboard replacement jobs to be found was completed recently in New York State's bustling Capitol building by electrical contractor E. G. May of Albany.

The significance of the project is found neither in size nor equipment, since connected load is below 300-kw and new service disconnects are standard electrically-operated ACBs with normal provision for manual control when required.

Yet, due to electrical conditions that introduced definite elements of hazard, physical conditions that made modernization unusually difficult, and service demands that made continuity of current mandatory, this task of switchgear replacement called for countless on-the-spot decisions related to procedure, constant vigilance to insure safety, and practical know-how of a high order.

Operation "Impossible"

Hazards in the forms of recurrent grounds and shorts had been caused primarily by age and water—both causes aggravated by local conditions.

For example; because lead-sheathed cables (installed in 1890) had been supported above the old open knife-blade board on metal racks, the deterioration of cable insulation seriously compromised safety. Shorts had repeatedly occurred due to vibration and to the inadvertent jarring of the racks. In addition, maintenance men occasionally had found nails and small plumbing accessories among the buses, evidently dropped in bygone decades by workers of other trades laboring above the open switchgear on scaffolds.

The problem of seepage and ground water had also been unduly serious because feeders had been carried from the switchboard to distant distribution centers through manholes, tunnels and pits which were generally submerged beneath several feet of water in spite of continuous pumping.

Physical conditions, likewise associated with age, also made the project difficult. This was true since the Capitol had been erected almost entirely prior to the age of structural steel and, as a result, masonry bearing walls were unusually massive. Outer walls measured over 16 feet in thickness, interior walls ranged from 5 to 8 feet, and catacomb construction had been employed consistently. Many of these thick walls had to be drilled to permit routing of feeders to otherwise inaccessible distribution panels.

Problems Were Numerous

Other physical handicaps included stepped ceiling levels, low headroom, numerous beam obstructions, heating and water pipes, and corridors frequently intersecting at other than at right angles. This necessitated the design and fabrication of special pull boxes and distribution panel extensions to accommodate feeders running at various levels in different directions.

Mandatory electrical continuitystill another factor contributing to a complicated assignment-was desired to satisfy normal governmental requirements of the Empire State, but it was demanded to insure communications operations of the State Police. This communication nerve center, including direct teletype contact with 13 other states as well as with all trooper stations throughout New York, precluded even momentary shutdowns. And a modern 3-way radio system (station-to-station, car-to-station, and car-to-car) likewise demanded uninterrupted power.

In other areas of the Capitol building, planned shutdowns were theoretically possible but actually difficult since light and power was recurrently requested on short notice for special night and weekend sessions of the Senate and Assembly, Court of Claims,

officials of the State University and other similarly important groups.

Progressive Substitution

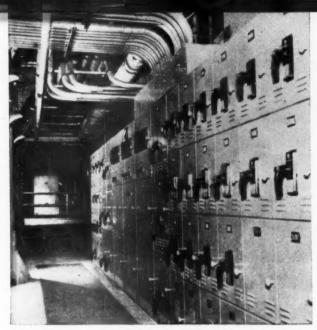
In revamping the system, the first step was to construct a scaffold above the old switchboard and encase live switching and bus structures with plywood. A pull box was then designed. extending the full length of the new board, and the front panel of this box was raised to the scaffold, then hung from ceiling beams at such a height that the lower edge of the panel just missed touching the wooden platform, New feeder conduits (including 5-inch Transite and both 31- and 4-inch rigid steel to deliver service to the new board from three separate 2300/208-120-volt vaults) were suspended from hangers along the ceiling and connected to this panel.

Simultaneously, in remote sections of the basement, distribution centers were being established, new feeders were routed back to the switching center and branch circuits were either added or, where they were to be reused, were shifted to the new control enclosures. In cases where continuity of service was imperative, dual feeders were carried so that power from the old board would be available up to the actual moment when the switchover was made to new breakers.

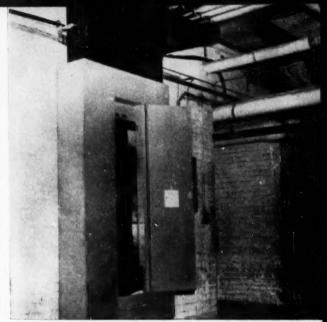
With distribution centers and new feeders in place, the new switchboard was then temporarily positioned in front of the old board and the old assembly was carefully dismantled section by section.

As old sections were progressively shifted backwards from their original positions, new cubicles were slid into the spaces vacated. This method was used to replace control cubicles and main 2500-amp disconnects as well. In this manner the old board eventually was entirely replaced.

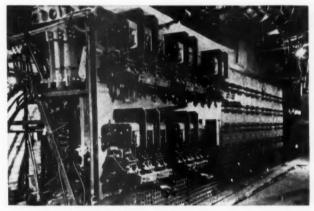
After all new switchgear had been positioned, the assembly of the overhead pull box was completed and the



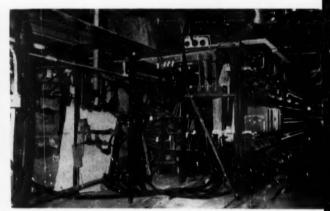
NEW CUBICLE-ENCLOSED SWITCHGEAR stands in exact position occupied by the old board which it replaced. New board and new overhead feeders were installed and placed in service without interrupting electrical service to head-quarters of State Police or to other critical areas in the Capitol building.



TYPICAL DISTRIBUTION CENTER controls feeders rerouted through massive masonry walls, along multi-level basement ceiling, between numerous pipes and ducts. This required the design of special pull boxes and panel headers, considerable drilling and fishing, and many decisions connected with mounting and conduit installation.



OLD SWITCHBOARD was source of repeated shorts and grounds due to deterioration of lead cable sheathing, existence of uninsulated metal cable racks, confined maintenance space behind bus! structure, open knifeblade construction and constant presence of water in feeder-carrying manholes, tunnels and pits.



SWITCHGEAR REPLACEMENT necessitated construction of scaffold over old board, suspension of new pull box from ceiling beams, carefully sliding sections of old board to the rear as new cubicles were eased into place from the front, running dual feeders to areas where shutdowns were impossible, and constantly observing safety precautions.

vertical sides of the box were secured to cubicle tops by means of specially formed filler sheets and collars.

Although the capacity of the old board was found to be adequate for existing lighting, air conditioning and power requirements, the original 2500-amp disconnects were replaced by 3000-amp assemblies and main breaker cubicles were sized to receive 5000-amp units if required due to future expansion. Space for additional cubicles was provided at both ends of the new board so that any expansion of service

in the future would not create an unanticipated problem.

The Question of Safety

When asked, "What specific safety precautions did you take?", job boss John Sofia referred to the plywood enclosures around the old board and also mentioned the extensive use of heavy rubber blankets which were placed around all temporary work as well as around the old still-hot bus structures.

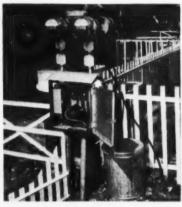
"However," he concluded, "the precaution paying the biggest dividend was in the employment of good men. We used only electricians having considerable experience in handling hot circuits, and having reputations for following Code practices and safety recommendations to the letter. As a result, our labor crew was smaller than would otherwise have been the case, and the job probably took longer to complete. Yet we believe that the wisdom of this decision was endorsed by the fact that, although the element of hazard was constantly present, accidents were completely absent."



PART OF A BLOCK of trailers with transformer enclosure in foreground. This unit feeds 67 trailers from 22 meter posts. Masts in background are TV antennas.



HIGH VOLTAGE CUBICLE in switchhouse contains metering facilities, main interrupter switch and three sets of powerfuse switches for switchhouse transformer.



TYPICAL METER POST supports cabinet housing feeder connections and fuse block; grounded Quel-Arc receptacles; and socket watthour meters.



TRAILER CONNECTION with cable from meter post. Note third wire of cable (arrow) bonded to trailer body. Post at right supports TV antenna.

OWN at the southern boundary of Chicago, near the Indiana state line, a modern trailer park is growing into what may be the largest development of its type in the country. Located at the south end of Wolf Lake, on a series of six "built-up" islands, the site is ringed by canals and will ultimately accommodate about 4,000 trailers in a "Venice type" setting. At present some 352 trailer spaces are available and adjacent ground is now being cleared to increase trailer-lot capacity. Park population now numbers about 900 persons.

This site is more than a mere lot on which to park a trailer. It has all the earmarks of becoming a "town within a city." Evidence that this was anticipated lies in the degree of engineering concentrated on utility services by Island Homes, Inc., the project developers, and L. I. Janik, project architect. The site has its own sewer system (individual connection to each trailer) which connects through a lift pumping station, with the city sewer system. It has city water and a fire hydrant system. A utility building provides laundry facilities. Future plans call for piping city gas into each trailer and having a telephone in each unit.

The same amount of foresight and engineering thought went into the design of the park electrical distribution system. Both the architect and owners wanted a trouble-free system with good voltage regulation, grounding features and relative freedom from lightning disturbances. And they did not want the area cluttered with unsightly poles and overhead lines.

Primary Underground Loop

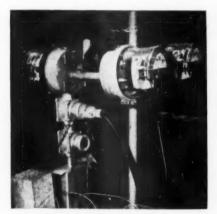
Goldberg & O'Brien Electric Company, contracting engineers of Chicago were called in to design the electrical system. The logical answer to the owner's desires was a high-voltage underground distribution scheme with relatively short secondary runs to serve groups of trailers.

Consultation with Commonwealth Edison Company engineers and City electrical inspection authorities led to the selection of a 2170/3750-volt (3750 volts phase-to-phase), 3-phase, 4-wire underground system using a directburial cable. Specifications for the primary cable called for No. 6, 1-conductor, stranded, 5-kv cable with alloy coated conductor, Semicon tape,1%4inch ozone resistant rubber insulation. 264-inch Neoprene bonded to the rubber, 2-.010-inch bronze tapes, impregnated fabric tape and layer of saturated jute. The neutral is No. 6, 1/C, stranded, 600-V, type RR cable.

The primary distribution scheme with its simplified underground loop is shown in Fig. 1. The incoming utility service terminates in a high voltage switching cubicle in the combination electric switchhouse and sewage pumping station. The five-section



TRANSFORMER CABINET interior showing 50-kva. dry type unit in background and primary cutouts in foreground.



CLOSEUP OF RECEPTACLE and meter connections. Three-conductor cable goes underground to trailer outlet. Ground connection is through receptacle shell.

cubicle contains the potential and current transformers for metering; a group operated, three-pole, 7500-volt, 400 ampere, main interrupter switch with external operating handle assembly; and three sets of 750-volt, 200-ampere, hook-operated, power fuse switches for the distribution circuits. One set of fused disconnects serves a 3-phase, 37½-kva, 3800/240-volt, dry type transformer and power distribution panel in the switchhouse. The other two sets serve the north and south feeders which comprise the underground primary loop.

To minimize digging hazards, the primary cables are buried some 40-inches below finished grade. Cables are tied together with cord and the outer sheaths are grounded at each end of the cable. Grounding facilities at the switchhouse consist of a ground bus, several ground rods and connection to the iron sewer main.

(Continued on page 199)

Deluxe Service To a TRAILER PARK

Underground distribution for a Chicago trailer park features a high voltage loop and trailer grounding provisions on secondary system.

> By J. W. Zinaveah, electrical engineer Goldberg & O'Brien Electric Company Chicago, Illinois

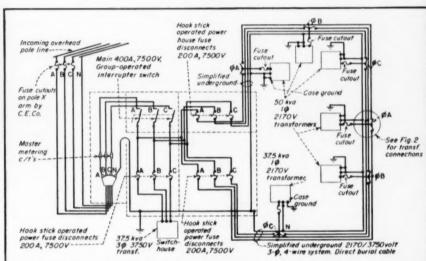


Fig. 1—PRIMARY DISTRIBUTION showing high-voltage switching facilities and 3-phase, 4-wire, underground loop system. Note phase-balance of transformer load.

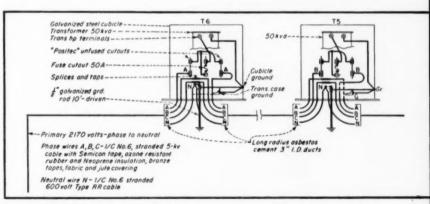
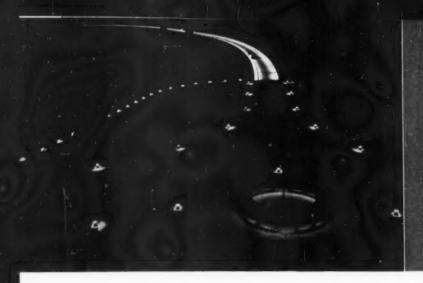


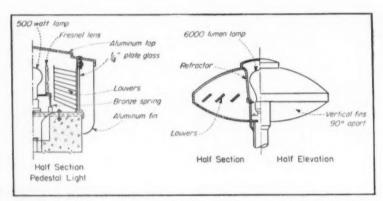
Fig. 2—TRANSFORMER CONNECTION schematic diagram showing method of phase connection to permit isolation of a feeder section or transformer during an emergency.



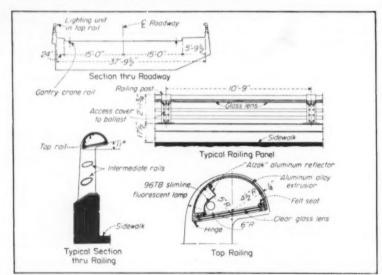


LIGHT magnificently outlines roadway atop. Shasta Dom at night (left), as well as the retunda, curving driveways, and parapet wall overlooking power house—all on the east abutment area. Daylight view is shown above.

AREA LIGHTING



DESIGN DETAILS of pedestal light (left) and parking area dome light (right), used for public and parking areas on east abutment.



HAND RAIL lighting details and position of railing with relation to roadway atop the crest of Shasta Dam.

A LL area lighting at Shasta Dam is accomplished by means of specially designed and custom-made luminaires and lighting equipment, which effectively conceal all light sources from nighttime visitors. Located in northern California's Shasta County, and operated by the U. S. Bureau of Reclamation's Shasta Dam Division, the facilities and property at the Dam are outlined in a pattern beauty and form at night rivaling its magnificent daytime appearance.

A roadway forms the crest of the dam, which is illuminated in a new and novel manner. Slimline fluorescent lamps are concealed in the two continuous railings flanking each side of the road. This roadway is 30 feet wide, with a 2-foot wide walk on the upstream side, and a 5-foot 91-inch wide walk on the down-stream side. The handrails, providing protection as well as concealing light sources for adequately lighting the roadway without sacrificing beauty of line, are 38-feet 3½-inches apart, center to center. The up-stream rail is 2,860 feet long, and the down-stream rail is 2,790 feet long.

Cast aluminum posts divide the railing into sections 10-feet 9-inches long, and every other post houses a two-lamp ballast. One 96-inch type F96T8 4500° white slimline lamp is installed in each rail section between the posts. The intermediate railing below the handrail serves as a wire raceway between posts. Dustproof flat clear glass lens plates set at an angle of 11° above the horizontal keep out dust and protect the lamps. An asymmetric specular finish Alzak reflector projects the





PARKING AREA adjacent to Vista house as it appears by night (left) and by day (above). Pole mounted aluminum domes reflect all light downward, completely shield light sources from spectators at Vista house.

at SHASTA DAM

Roadway and parking area lighting at Shasta Dam features special design luminaires and continuous row fluorescent lighting from crest hand railings which conceal all light sources from view of spectators.

By Berlon C. Cooper



A total of 528 slimline lamps are used in the two railings, and operate from a 120/240-volt single phase service. They operate at 300 ma, and result in an approximate 48 kw load.

Average illumination intensity provided on the roadway is 3 footcandles, and varies from 2 footcandles in the center of the roadway to 12 footcandles on the centerline of the up-stream sidewalk.

The east abutment area is lighted by cast aluminum pedestal type units approximately 3 feet high. Each pedestal is equipped with a 500 watt type PS40 incandescent lamp accurately positioned within a 360° Fresnel cylinder lens which refracts the light out at an angle below the horizontal in a complete circle around the pedestal. Louver fins encircle the Fresnel lens radially, to conceal it entirely above the horizontal, so that only the area sur-

rounding the pedestal in an approximate 40-foot radius is illuminated.

In a parapet wall located on the east abutment and overlooking the power house are installed 35 fluorescent reflector units using type 42T6 slimline lamps which direct all their light downward to the walkway. These are located on varying centers ranging from 22 to 27 feet, and are installed 22 inches above the sidewalk level. Thus they light the walkway, but conceal direct light from the eyes of the pedestrian spectators.

The public parking area adjoining the Vista house is illuminated by louvered aluminum hood units installed atop 25-foot aluminum poles. These units are equipped with 6000-lumen lamps, each in a glass refractor, which directs the light downward to the parking area through angled circular louvers. The hood, and vertical fins set 90° apart under the hood, shield

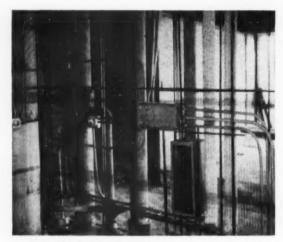


PEDESTAL LIGHTS on east abutment area are cast aluminum. Attractive by day, they direct a circle of light around each unit at night to light the driveways and conceal the light below the horizontal.

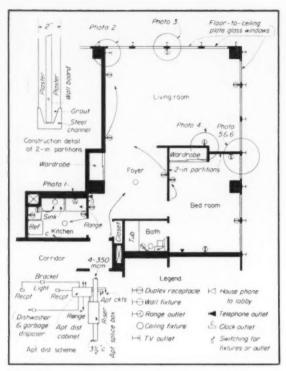
the refractor and light source completely below the horizontal. These units are series-fed by a 15 kw constant current transformer. The roadway leading up to the east abutment area is also illuminated by oval type 10,000 lumen mercury vapor street lighting aluminum luminaires mounted on 25foot aluminum poles and bracket arms. These are also series connected.

Power for lighting is supplied at 2400 volts primary from a distribution vault in Shasta Dam, and stepped down to 240/120 volts, or to 6.6 amp series circuits and as required for the various lighting loads.

The east abutment lighting was installed by the Vincent Electrical Motor Co., Oakland, Cal., and all lighting equipment, including the cast aluminum pedestals and crest hand railing, were manufactured and supplied by the Columbia Electric & Mfg. Co., Spokane, Washington.



APARTMENT DISTRIBUTION center in kitchen. Panel is connected to riser splice box. EMT circuits leave panel to serve kitchen and other rooms. (Photo 1)



PLAN OF typical department. Note outlets at window-walls and 2-inch partitions, circled and keyed to photograph.

It's Tough to Install . .

OUTLETS in TIGHT PLACES

... but the Geo. W. Reinke Electric Co. hurdled the obstacles of full length window-walls and slim partitions in Chicago's Lake Shore Drive Apartments.

OTED architect Mies van der Rohe's dream of a glass tower apartment building became an actuality when Chicago's Lake Shore Drive apartments were built under the supervision of Pace Associates, associate architects, Chicago. The twin units are 25-story, steel faced, structural steel frames filled with glass. Exterior walls are floor to ceiling windows. Interior partitions between apartments are of gypsum block construction. Room partitions within apartments are only two inches wide, consist of a solid wallboard core with plaster coats on each side.

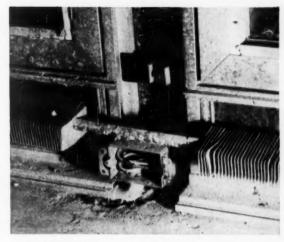
A soundly engineered electrical system has sufficient service and feeder capacity and enough apartment branch circuits and outlets to rate Adequate Wiring Certification—reportedly the first large apartment project in Chicago to achieve this goal. Sequence service equipment in the basement of each building has 2,400-ampere mains and distribution switches to serve the required number of vertical risers (four, 350MCM cables in 3½-in. conduit per riser) for the 120/208-volt, 3-phase, 4-wire system. Feeder taps are made in deep splice boxes at each apartment. Individual apartment distribution panels are located in the kitchen; consist of a 60-ampere main pull-out type fused switch, a 60-ampere range switch, plus four plug-fuse branch circuits for small apartments and six for the larger units. All wall switches at door locations are mounted at door-knob height.

Because of the space limitations imposed by the open type construction and basic structural design, branch circuit work posed the biggest problem for Reinke Electric Company, project electrical contractors. Most difficult were the installation of EMT circuits and outlets along the window-walls and in the solid two-inch partitions. Thin-wall conduit stubups at partition lines had to be "on the nose" to keep boxes within the narrow partition width. Wallboard had to be cut to accommodate boxes and conduits. Type of outlet box varied with specific application; ranged from shallow "1900" to shallow "Sliktrik" type requiring no plaster ring.

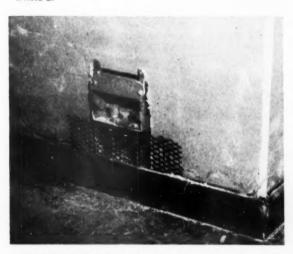
Reinke's solution to these problems is outlined in the accompanying photographs. Check the plan view of a typical apartment to establish outlet locations. Note the detail of solid partition construction. Follow the circled outlets keyed to the photos. Then study installation technique in each case.



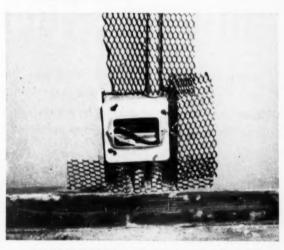
TV RACEWAY of 3/4-in. conduit runs up building column, and has an outlet in the living room of each apartment. (Photo 2)



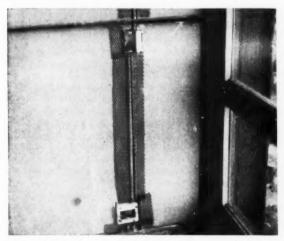
WINDOW-WALL is sandwiched between fins of perimeter heating system at floor level. Short 90° connector ties box to raceway. (Photo 3)



WALLBOARD IS CUT in solid 2-in, partition to take outlet mounted on conduit stubs. "Sliktrik" box requires no plaster ring. (Photo 4)



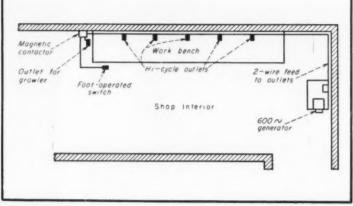
WHERE BASE OUTLET in narrow partition also serves as junction box, shallow 4-in, box is used. Metal lath is stapled to wallboard. (Photo 5)



WALL SWITCH outlet with "Sliktrik" box is tied to outlet and junction box at partition base. Metal lath strip covers conduit on both sides of wallboard. (Photo 6)



NARROW PARTITION has a solid wallboard core (arrow) grouted in a steel base channel. Plaster coats on both sides fill out the 2-inch width. (Photo 7)



Testing With

FIG. 1. Layout of hi-cycle circuits and equipment affords quick and convenient use of the testing facilities.

HI-CYCLE VOLTAGE

Foolproof detection of faulty motor and transformer windings. That's the big story on the use of a hi-cycle generator for quick and positive overpotential testing. And its range of auxiliary applications is almost unlimited.

By Samuel Heller, P. E.,

Consolidated Electric Motor Company, New York, N. Y.

HIGH frequency (120-cycles and up) power source with an output of several hundred volts offers a wide range of quick and sure motor shop tests. As a primary test device, its hi-cycle output can be applied directly to overpotential testing of motor and transformer windings. In conjunction with a special high frequency growler or high frequency transformer, it is readily adapted to overvoltage testing of windings as small as a single motor coil and as large as a 26,000-volt transformer winding. These and other useful applications make a high frequency voltage source a versatile complement to the usual test equipment in any shop.

Theory

The distinct advantage of high frequency testing lies in the impedance characteristics of any circuit to which hi-cycle voltage is applied. The ac impedance of any coil or winding is essentially directly proportional to the frequency of the voltage impressed

across it. This is evident from the formula for inductive reactance— $X_L=2\pi f L$, where f equals frequency in cycles/second and L equals the inductance of the winding. In any winding then, the high impedance set up by the high frequency permits application of several times normal voltage to the winding circuit without high current flow and consequent heating in the winding. In hi-cycle tests, the total test voltage is distributed uniformly around the turns of a winding, developing unusually high turn-to-turn voltages.

High frequency overvoltage tests have no harmful effects on any winding which is free from faults. With even three times the normal voltage applied, the high impedance of the winding can limit the current to a value well below the continuous duty rating. If, however, an actual or incipient short should exist between the turns of a winding, high frequency overvoltage testing will reveal the trouble in a matter of seconds. Be-

cause the indication of a fault is either excessive heating, smoking or explosive "blowout" in the winding, high frequency testing is often called "destructive testing". For this reason, test results are invariably quick and positive.

The ability of high frequency testing to ferret out and reveal very high resistance shorts, and even points of possible shorting which would most likely short soon after the winding had been in service, again derives from the hi-cycle alternations of the voltage. In any winding to which high frequency voltage is applied, stresses and relaxations are set up in the wires due to the alternating magnetization forces. Commonly called magnetostriction, this effect agitates and vibrates the wires to such an extent that contact between turn conductors will be made if there is any place for it to occur, that is, if there is nothing in between physically to prevent contact between the conductors. In the case where a fault does exist, this agitation is aided by the high turn-to-turn voltages in "making" the point of short.

Shop Set-up

Here in the shop at Consolidated, we have selected and laid out equipment which provides a variety of high frequency test applications. We use a 600-cycle power source with its output fed to six outlets spaced along the length of a work bench and mounted close to the wall at the back of the bench. (Fig. 1) A two-wire test cord with a plug on one end and insulated clips on the other is provided at each high frequency outlet.

Our 600-cycle source is an old (about 1917) single phase generator which was originally used in a submarine. (Fig. 2) The generator is

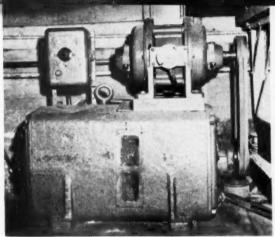


FIG. 2. Hi-cycle source consists of 600-cycle generator and dc generator on common shaft in cast iron housing, 220-volt 3-phase motor on top V-belt driving the generator rotors.

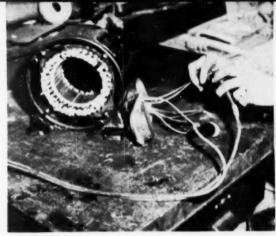


FIG. 3. Direct high frequency test is made by clipping the insulated hi-cycle test clips across finished stator windings. If defect exists, winding will be destroyed.

contained in a cast iron housing and has a shaft common with what was originally a dc motor generator-drive. We extended the shaft on the dc motor end and coupled it by V-belt to a 220-volt, 3-phase, 10 hp motor mounted on top of the generator housing. The old dc drive is now a dc generator which provides excitation for the high frequency generator. This dc excitation can be varied between 0 and 110 vdc by a rheostat, which in turn varies the 600-cycle generator output between 0 and 500 volts.

For use in conjunction with the high frequency source, we have also prepared a special high frequency growler. This is nothing more than an ordinary 220-volt, 60-cycle growler rewound for 400-volt, 600-cycle operation. As a result of this rewinding from 60- to 600-cycles, the effective capacity of the growler was increased from 1 kva to 10 kva, due of course to the 10-times increase in the impedance of the winding. The growler is equipped with a power cord and plug for connecting to one of the high frequency receptacles. To provide proper growling procedure, the high frequency outlet for the growler, the one at the end of the bench, is fed through a 110-volt ac contactor which is controlled from a foot-operated switch. In this way, the growler can be energized locally by the operator, keeping the test procedure under close control.

Direct Testing

The 600-cycle generator output can be applied directly to testing finished stator windings. (Fig. 3) In this application, the insulated hi-cycle test clips can be connected phase-to-phase, phase-to-wye or to only a partial winding. For this type of test, the initial voltage applied to the winding is about equal to the rated voltage of the winding. The test voltage is gradually increased by the rheostat on the exciter until about double rated voltage is across the winding. If a short exists anywhere in the winding, the destructive effect of hi-cycle overpotential testing will reveal it immediately.

In an actual case of testing on a 5 hp motor, hi-cycle is connected across phases 1 and 2, then across phases 2 and 3, to complete the entire winding. At 220-volts, 600-cycles, this winding takes about 9 amps; whereas at 220volts, 60-cycles, the winding would take 90 amps. As can be seen, the frequency determines the current by reason of the direct proportion between frequency and the impedance of the winding. Here, we have the advantage of overpotential testing without the disadvantage of excessive current flow-the application for an indefinite period of twice the rated

Our usual procedure in direct hicycle motor testing is to connect from leg to leg on 220-volt motors, and from leg to wye or across a partial winding on 440-volt motors. We use from 450 to 500 volts on 220-volt windings. This gives us at least double the volts between turns that would normally be encountered in use.

Direct testing with the hi-cycle output can also be made on single phase stators. In such cases, it can be used for testing after completion of a winding, and for testing in many cases where the customer demands that only a starting winding be wound-in. We test either the entire winding in series or separate poles. Usually within a few seconds, a damaged pole will heat up or smoke.

Another application for direct hicycle testing is in trouble-shooting on the fields of large and small serieswound dc and Universal motors. We recently made this test on the motor of a small electric drill. Although the armature had been wound three times elsewhere, sparking still persisted in the motor. The fields tested perfectly with the usual types of test. However, when 600-cycles was applied across them in series, one of the fields smoked up instantly. Upon opening the field, we found that it had been damaged badly, although there was no visible sign of any heating on the outside.

Hi-cycle trouble-shooting is particularly effective on large, series-wound blower motors and automobile type electric motors. In these types of motors, it is unusually difficult to determine if the winding is good or bad without actually opening-up the complete winding, taking out the pole pieces and visually examining the inside of the winding. At best, this is a poor test method. But quick and sure test results can be had with application of 600-cycles which often causes a faulty winding to explode almost instantly.

Hi-cycle Growling

In addition to its use in direct testing, the output of the high frequency generator is used with our special hicycle growler. One of the basic uses for this growler, energized with 600-cycle voltage, is testing for shorts in single coils and coil groups before they are placed in windings. Individual coils are tested by placing one side of the coil in the slot between one of the growler poles and a special laminated adapter piece which is hooked over the other pole piece. (Fig. 4) The foot-switch is then depressed to en-



FIG. 4. Single coils are tested by placing one side in slot between growler pole and adapter piece on top.



FIG. 5. Coil groups are tested for shorts by holding one side of the group in the field above the hi-cycle growler.



FIG. 6. Removing stators from motor housings is made easy by heating the housing with the hi-cycle growler.

ergize the growler which is plugged into its special hi-cycle receptacle. If a short exists in the coil, a voltage will be induced in the closed circuit, and the resulting current in the coil will react with the magnetic field producing motor action which causes the coil to jump out of the slot. If the coil is sound there will be no tendency to move out of the slot.

Similar tests, can be made on coil groups with the adapter piece removed. (Fig. 5) In both coils and groups, as much as 12 times normal voltage can be developed to force current flow at possible short points.

One of the most effective uses for the growler is in determining if a rotor is balanced and hooked up properly. In this test, we place the rotor in the growler with a voltmeter across any phase of the rings, say ring 1 to ring 2. We then rotate the rotor slightly until the meter reads maximum voltage. Repeating this procedure for meter readings from ring 2 to ring 3 and from ring 1 to ring 3, we note the peak voltage obtained in each case. For proper balance and hook-up, the three voltage readings should be the same. This test can be made on any type of rotor whether it is a parallel circuit or not. But parallel circuit rotors cannot be growled in the ordinary way because the parallel circuits show a short throughout.

Transformer Tests

An obvious use for high frequency is in overpotential testing of large transformers. High frequency makes it possible to induce in the transformer testing-voltages far in excess of the transformer's operating voltages without excessive current. And the power requirements for high voltage transformer testing are held to reasonable limits by the impedance increase in the winding due to high frequency. Without hi-cycle, the power which would ordinarily be needed to induce only the rated voltage of a large transformer would be more than most shops have available.

Recently, we had occasion to wind a 1000 kva, 26,000-volt primary, 2400-volt secondary transformer. As a test, we decided to subject the primary to a full 52,000 volts. To do this, we first connected the output of the hi-cycle generator to a 600-cycle transformer with a secondary output of about 4000 volts. This secondary voltage was then impressed across the 2400-volt secondary of the unit under test, inducing about 52,000 volts in the primary. The test conformed to the AIEE, NEMA and "American Standard Test Code

for Distribution Power Regulator Transformers." The duration of high frequency application was carefully limited to about 12 seconds in accordance with prescribed data.

Special Uses

As a practical testing device, high frequency can be readily adapted to an almost unlimited range of uses. Suggestive of many other applications is its use in removing stators from motor housings. To do this job, the motor housing is placed on the growler, which is then energized by closing the foot-switch. (Fig. 6) In just a few seconds, the eddy currents and hysteresis losses set up in the housing by the hi-cycle magnetic flux will make the housing almost too hot to handle. Expansion and softening due to this heating loosens the stator which can then easily be removed.

Another interesting application of high frequency was developed during some work we did recently on a 600 hp, 4300-volt motor. We were asked to examine this motor which had been rewound in another shop. Although the ammeters in each line read balanced, the machine heated badly on one particular section. There seemed to be no apparent reason for the heating. The coils themselves did not seem to get too hot; but the core in the bad section got so hot we could smell it from 10 feet away.

The machine had recently been struck by lightning, and apparently some damage had been done to the core which was heating from weldover. We examined the motor and found that a careful job had been done of separating the laminations and slot teeth. There was, however, a minute quantity of bronze dust on the bottom of one of the slots. To test, we used the core of the stator as a donut type current transformer. We wound through it about 35 turns of No. 8 flexible wire with most of the turns around the section which appeared faulty. When high frequency was applied to this winding, the stator slot laminations heated up within a fraction of a second. To make certain that the heating was due to a defective slot and not to the hi-cycle, we moved the turns to another section about 10 slots away and could obtain no heating over a period of 5 to 6 minutes. Then, with the high frequency applied to the adjacent slot, we ground away at the bottom of the defective slot until no heating occurred. In all, the job took six hours; but the use of high frequency made the results positive and assured complete correction of the fault.



DRILL-OPERATED SCISSORS JACK raises and holds heavy bus duct sections FEATURES OF JACK include mobile base with being mounted to a four-foot ceiling. Unit cut about one-third from normal parts trays; convenience outlet; sturdy linkage installation time for duct system under these conditions.



with five-foot elevating screw; duct platform.

A LIFT JACK FOR BUS DUCT

Westphal & Co. built an over-size scissors jack, operated by a standard electric drill, to install bus duct in a low-clearance area.

OB conditions crop up on almost all electrical construction projects and present problems that may harass the electrical contractor. How effectively he solves them may determine the color of ink used to close out his contract ledger.

On a recent Wisconsin industrial plant project, Westphal & Co., electrical contractors in Janesville, had to install a 400-amp, 3-phase, 4-wire, 480/277-volt bus duct distribution system within a four-foot clearance in the basement area. Although ceiling slab inserts had been installed to mount the duct and other piping systems, there wasn't any method of mounting

block and tackle to raise the heavy (166 lbs. per 10 ft. section) duct sections. And there wasn't enough head room for electricians to work in a standing position.

While pondering the problem, Westphal manager C. W. Brown and job superintendent C. L. Caroll recalled the advantages of the common automobile scissors jack for tight-clearance work. Here was the answer. The result of a few pencil sketches and calculations was the design of an oversize scissors jack operated by the standard 1-inch electrical drills on the

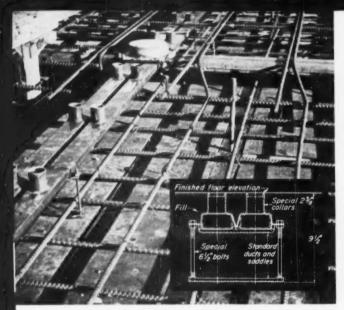
The unit rests on a sturdy base (33

inches by 28 inches) made of 2-inch angle iron and rolls on four swivel wheels equipped with brakes. Parts trays on each side of the linkagemount hold boxes of washers, screws, nuts and other accessories. A duplex outlet on the side provides connection for the electric drill and work light.

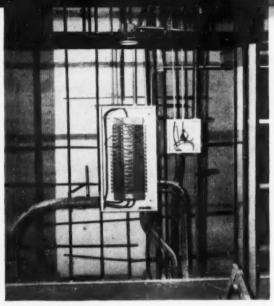
Lengths of sturdy 1-in. by 2-in. flat iron make up the pantograph linkage which terminates in a top platform with guide brackets to held bus duct sections. A five-foot, one-inch diameter elevating screw has a ball thrust bearing at one end for easy operation. Both ends of the screw shaft are turned down to fit a 4-inch drill chuck. An electric drill mounted to one end of the shaft raises the jack. When fastened to opposite end, the drill lowers the platform. Duct sections can be raised up to a six-foot height with the

Carroll normally uses a three-man crew with the lift jack. One man operates the jack, one makes the duct support and bus bar connections. The third man "makes ready" by unpacking and preparing the stacked sections of

By using this combination-lift jack and team work-Westphal engineers estimate they were able to reduce by one-third the time normally required to make a duct installation under these conditions. It's another outstanding example of ingenuity and fatiguereducing mechanization provided by an electrical contractor.



DEEP OUTLET COLLARS and long saddle bolts were used to keep underfloor ducts within central half of reinforced-concrete floor slabs. Unusual thickness of slab was necessary due to scarcity of steel beams originally specified for standard floor construction.



RECESSED LIGHTING panels and telephone pull boxes, downlights beneath stepped plenum chambers, conduits and conductors, air conditioning diffusers and P-A speakers were roughed in prior to application of finished plaster coat over metal lath in open office areas.

BANKED TRANSFORMERS Serve Ingenious Wiring Design

URING the recent period of restrictions on the use of critical materials, many potential builders faced the alternative of shelving plans for an indefinite future or of modifying initial designs to bypass unobtainable items and delivery bottlenecks. Many of those who proceeded did so only by developing unique construction methods or adopting variations in standard design practices.

This type of ingenuity and adaptability is plainly evidenced in a modern office building recently completed for the California Western States Life Insurance Company in Sacramento; the product of architects Masten & Hurd, electrical consultant Harold Gerber of the A. A. Coddington Company, and electrical contractor George Foss. This structure also indicates close cooperation, because many of the structural and electrical problems were so interrelated that changes in one necessitated changes in the other.

For example, inability to obtain steel beams led to the design of a reinforced concrete floor slab of greaterthan-normal depth. This in turn affected the initial design of the underfloor duct system, resulting in changes of duct elevations above slab forms, design of outlet collars and methods used for duct support.

Other problems were solely electrical, such as the necessity for finding acceptable substitutes for unobtainable sizes or limited quantities of desired cable, switchgear and transformers.

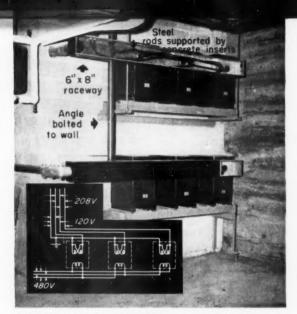
Due to this condition several normal procedures of design had to be reversed, first determining what materials were available, then deciding how these materials could be utilized effectively. It is significant to note that most of these problems were solved not merely by adequate solutions but by advantageous solutions contributing definite plus-values to the installation.

A case in point is the adoption of single-phase transformers to serve the 3-phase lighting system.

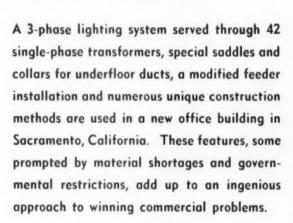
Banks of Single Phase Transformers

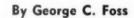
With primary service at 480-volts 3-phase 3-wire and with lighting and receptacle distribution at 120/208-volt 3-phase 4-wire, design alternatives weighed 480-volt feeder distribution against low voltage, a centralized location of a single substation against several load-center assemblies, 3-phase transformers against banks of singlephase units, oil against air cooling, and fewer large-diameter feeders against a greater number of smallersized cables. Availability of material had considerable influence in all of these decisions. Yet each decision was logically justified prior to its final acceptance.

The result was an installation consisting of 14 three-unit banks of single-phase air-cooled transformers wired

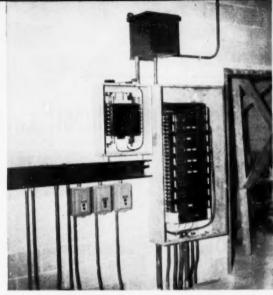


SINGLE PHASE TRANSFORMERS are connected delta-wye in groups of three to provide 4-wire 120/208-volt service for upper floors. Support is provided by channel racks, angles bolted to walls and hangers secured to overhead inserts. Rectangular raceways enclose all wiring.

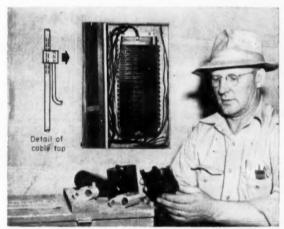




Electrical Contractor, Sacramento, Cal.



COMPACT INSTALLATION of 480 and 120/240-volt breaker panels, single-phase transformer, square metal raceway, push-button magnetic motor starters, exposed branch EMT and riser conduits is located in each elevator penthouse. Wires in raceways and gutters are tied for neatness.



ADJACENT LOCATION of risers and lighting control panels shortens lerigth of take-off cables, conserves copper, eliminates voltage drop. Bakelite-enclosed split-type cable taps are compact, safe, quickly installed and secured by means of recessed hex-head bolts.

delta-wye, with secondaries interconnected to form the desired 4-wire grounded neutral system. Neutral points of the Y were grounded at each transformer location through separate conductors in raceways, with conductors connected to the cold water system by cast type ground clamps. Two banks of three units each are located in the basement at the base of each of six low-voltage risers, while two additional banks of three units are separately mounted to serve basementbased control centers.

Transformers are supported on

channel frames secured to concrete walls by angles, brackets and expansion bolts, or are suspended from ceiling slabs by hanger rods and concrete inserts. All wiring connected to these transformers, both primary and secondary, is enclosed in rectangular metal raceway.

In selecting locations for mounting these transformer banks, attention was given to accessibility for inspection and maintenance, adequacy of ventilation for cooling purposes, and protection of the units against moisture and dust. The method of mounting—that is, close to walls, tierred and out of the way—releases floor space for other purposes. And the location of transformers at the base of the various risers results in shorter secondary feeders and less voltage loss.

Advantages of the installation are numerous. Units, being small in size and light in weight, are easy to handle and install. They are also compact in construction, occupying little space. Since units are all of popular standard ratings, they are generally available with minimum delay in delivery.

(Continued on page 122)

ESTIMATING CONDUIT ENTRANCES

By Ray Ashley

Research and Consulting Engineer Chicago, Illinois

QUESTION: Must conduit entrances for outlet boxes always be counted to insure accurate estimating?

ANSWER: No. In general, each box can be considered as having two conduit entrances.

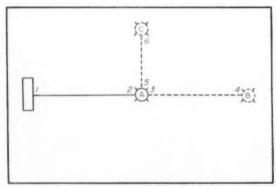


FIG. 1—EACH OUTLET IS CHARGED with two conduit entrances. The one at the fuse center is charged to outlet "A". Each additional outlet installed involves two more.

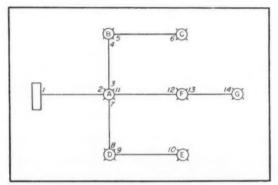


FIG. 2—THIS LAYOUT HAS seven outlet boxes and fourteen conduit entrances. Start at fuse center and count them. Regardless of number of outlets, total conduit entrances will be twice the number of boxes installed.

DISCUSSION: For every outlet box installed there will be two conduit entrances involved. Let's study Fig. 1 and see how this works out. When outlet "A" is installed, there will be two pipe entrances "1" and "2"; the first at the fuse-center and the second at the outlet itself. Add outlet "B" and there are two more entrances "3" and "4". No. 3 is at outlet "A" and No. 4 is at outlet "B". In like manner, two more conduit entrances will be involved when outlet "C" is added to the system.

Follow the same pattern in Fig. 2 and you will find seven outlet boxes and a total of fourteen conduit entrances. It makes no difference whether one or one thousand outlets are installed, there will always be exactly two conduit entrances for each outlet.

It is good estimating practice to have one outlet-box labor unit designed to cover the cost of installing outlets with either ½-in. or ½-in. knockouts or hubs.

Along with such box units goes a \(\frac{3}{4}\)-in. conduit labor unit which is sufficiently greater than the \(\frac{1}{2}\)-in. conduit unit to take care of the extra bulk of conduit installed.

A previous article (EC&M, June 1952, page 67) provided a study of outlet-box labor units. In that table of labor operations, pipe threading is the only item that would be materially affected by using \(\frac{1}{4}\)-in. conduit. However, the difference between the time required to thread \(\frac{1}{2}\)-in. and \(\frac{3}{4}\)-in. conduit is not great enough to warrant separate labor units. Outlet boxes with 1-in. conduit entrances must be noted.

Time studies show that boxes with 1-in. pipe entrances require from 12 to 15 percent more installation time than those with the ½-in. and ½-in. openings. In addition to the extra time for cutting and threading the conduit, there is a possibility that the box may have to be reamed.

Outlet boxes with hubs are more likely to require special attention than those of the knock-out type. It is common practice among electrical contractors to favor boxes with $\frac{3}{4}$ -in, hubs when working on installations involving a mixture of $\frac{1}{2}$ -in, and $\frac{3}{4}$ -in, conduit entrances. The additional cost of fittings and adapters for the $\frac{1}{2}$ -in, conduit is offset by the saving in time.

Locknuts and bushings generally can be estimated with sufficient accuracy without counting the different sizes of conduit entrances. One knows that the total number of locknuts and bushings will each be equal to twice the number of outlets, except where double locknuts are required. A cursory examination of plans usually will enable one to estimate the approximate quantity of various sizes. It is far more economical to send a few extra locknuts and bushings to the job than to spend time making an accurate count.

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(Factory, pg. 104, December '51)

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How To Connect H. V. INDUSTRIAL CABLE

By A. C. Laird

Anaconda Wire & Cable Co.

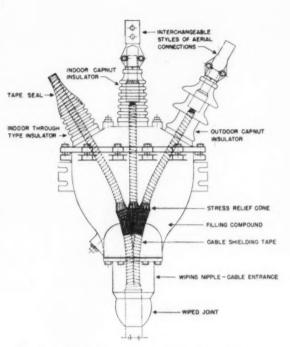


FIG. 1—"Composite" drawing of multi-conductor pothead showing three different types of insulators.

A roundup of methods for jointing and terminating 4,160- to 13,800-volt cables as encountered in industrial distribution systems.

AFRIAL LUG

INSULATOR

FILLING COMPOUND

STRESS-RELIEF COME

STUFFING BOX

PACKING

STUFFING NUT

FIG. 2—Outdoor-type pothead with mechanical stuffing box entrance for single-conductor, rubber-insulated, shielded, nonmetallic-sheathed cable.

ABLE terminations and joints described in this article are for use from 4,160 to 13,800 volts, the operating voltages normally encountered in industrial insulated power cable installations.

Insulated cables are manufactured using modern, specially-designed machinery under ideal factory-controlled conditions. Frequently the cables must be installed, terminated and joined under extremely adverse conditions. Tightness against moisture and contamination, and care in installation are vitally important.

Due to the countless possible types of cables and installations requiring various types of terminations and joints, it is not possible to cover all, but those to be described are typical.

Multi-Conductor Potheads

The insulator mounted at the righthand side of the assembly shown as Fig. 1 is the outdoor "petticoat-type" designed for installations exposed to outdoor weather and atmospheric conditions. The center insulator is of the "corrugated-type" designed for installation indoors where not exposed to the more severe conditions encountered outdoors. The insulator shown at the left of the assembly is generally referred to as "indoor through-type". Potheads using this type insulator are not generally recommended, particularly for paper-insulated cables, since they rely on a taped seal for tightness. The mechanically sealed type will provide a tighter and more reliable assembly at little additional cost.

Multi-conductor potheads are available in many different interchangeable shapes, types of entrances, and styles of aerial lugs to suit the conditions of installation. The shape of the pothead (straightaway, elbow, angular, etc.) is determined by the direction from which the cable must enter the pothead. The style aerial lug (bus-bar lug, clamp-type, etc.) depends on the type of connection desired between the pothead and other equipment. type cable entrance depends on the external construction of the cable (wiped-joint for lead-covered, stuffing box for nonmetallic-sheathed or leadcovered, or pipe-connected if the pothead is to be mounted directly onto the end of a conduit). Entrances can also be provided to accommodate 2, 3 or 4 single-conductor cables.

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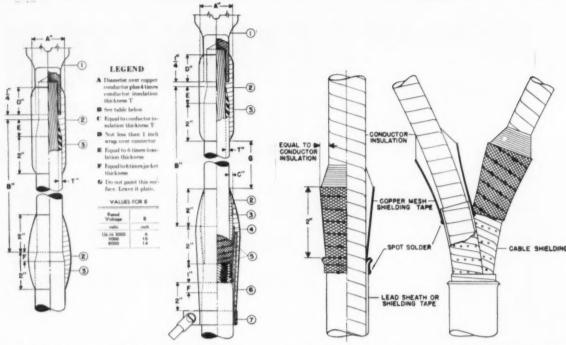
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FIGS. 3 and 4—"Taped-Type" termination for single-conductor, non-shielded (left) and shielded cable.

 $\textbf{FIGS. 5} \quad \textbf{and 6} \\ \leftarrow \\ \textbf{Stress-relief cone for single-conductor cable} \\ (\textbf{left)} \quad \textbf{and multi-conductor cable}.$



FIG. 7—Typical 60-cycle flash over a shielded type nonmetallic-sheathed cable which has not been properly reinforced with a stress-relief cone.

Taped Terminations

Fig. 3 and Fig. 4 show methods for terminating single-conductor, rubber-insulated, nonshielded or shielded-type, nonmetallic-sheathed cables such as neoprene-jacketed or braid-covered, without the use of potheads. For non-shielded cable termination, Fig. 3, note that the nonmetallic sheath is removed from the insulation for a specified distance depending on the voltage. This is done because of the relatively low surface resistivity and poor "tracking" properties of these coverings.

For the shielded cable termination shown as Fig. 4, attention is called to the stress-relief cone, grounding strap, and clamp for grounding the cone and cable shielding.

Taped-type terminations are recommended up to ratings of 8000 volts. Above 8000 volts, more reliable and longer-life trouble-free service will be obtained by terminating the cable in properly-designed potheads. Fig. 2 shows a recommended pothead-type termination. Note the stuffing box cable entrance and grounding of the stress-relief cone and shield to the pothead assembly.

Stress-Relief Cones

Stress-relief cones are "built-up" on insulated cables at the point where the lead sheath or the cable shielding tape terminates, for the purpose of relieving the concentration of electrical stress at these points,

Stress-relief cones are recommended for terminations of the following types of cables: Figs. 5 and 6

- 1. Single-conductor, lead-covered cable operated at 8000 volts and over.
- 2. Single-conductor, shielded, non-metallic-sheathed cable.
- 3. Multi-conductor, shielded, lead-covered cable.
- 4. Multi-conductor, shielded, non-metallic-sheathed cable.

For varnished-cambric or paper-insulated cables, the cone is built-up with varnished-cambric splicing tape and covered to the high point of the cone with bare copper mesh shielding tape. For rubber-insulated cable, the cone is built-up with self-vulcanizing rubber tape and shielded with tinned copper mesh tape to the high point of the cone. Stress-relief cones and shielding tapes of shielded-type, nonmetallic-sheathed cables must be permanently and substantially grounded at terminals and joints of such cables. Any shielding not properly grounded should be treated as an energized conductor. Responsibility for properly grounding the shields rests with the installer.

Single-Conductor Straight Joints

The general design for a straight joint in single-conductor lead-covered cables is shown in Fig. 8. For 8000 volts and above, shielding of the joint is recommended as shown in Fig. 9. The shielding consists of copper mesh tape tightly wrapped over the handapplied tape insulation, completely across the joint and spot soldered to the lead cable sheaths. These joints are insulated with bias-cut varnished-cambric splicing tape.

Fig. 10 and Fig. 11 show designs for jointing single-conductor, rubber-insulated, nonshielded or shielded, nonmetallic-sheathed cables. Note in Fig. 10 the neoprene jacket is left on the insulation. For braid-covered cables, the braid covering must be removed from the insulation for a suitable distance (about 3 inches) to prevent "wicking" of moisture into the joint along the braid. For jointing shielded-type cable as shown in Fig. 11, it is essential that the shielding be continuous across the joint. This is accom-

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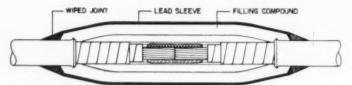


FIG. 8—Straight joint for single-conductor, 5000-volt, paper- or varnished-cambric-insulated, lead-covered cable

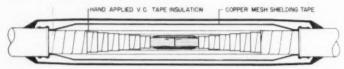


FIG. 9—Straight joint for single-conductor, 8000 volts and higher, paperor varnished-cambric-insulated, lead-covered cable.

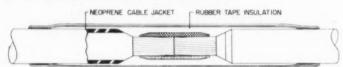


FIG. 10—Straight joint for single-conductor, rubber-insulated, nonshielded, nonmetallic-sheathed cable.

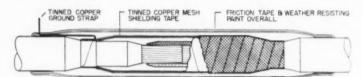


FIG. 11—Straight joint for single-conductor, rubber-insulated, shielded, nonmetallic-sheathed cable.

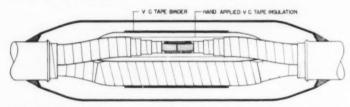


FIG. 12—Straight joint for multi-conductor, belted-type, paper- or varnished-cambric-insulated, lead-covered cable.

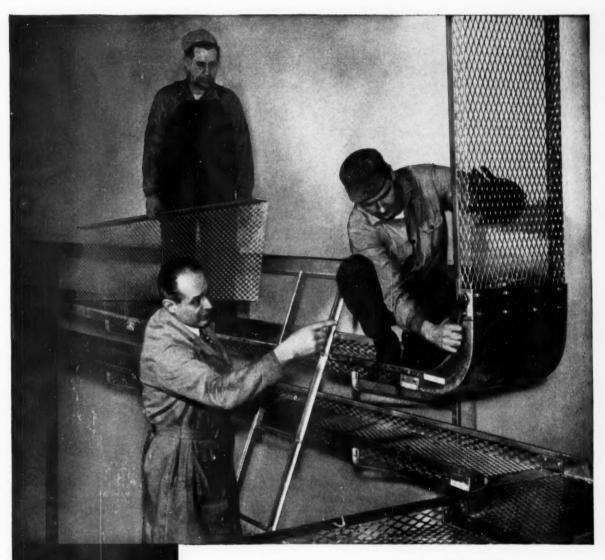
plished by tightly wrapping tinned copper mesh tape over the rubber tape insulation and spot soldering to the cable shielding tapes. Note the ground strap for grounding the joint and cable shielding. Joints for rubber-insulated cables are insulated with self-vulcanizing rubber tape. Overall protection is provided by two tightly-wrapped half-lapped layers of friction tape, each layer painted with a good weather-resisting cable paint.

Multi-Conductor Straight Joints

A straight joint for multi-conductor, belted-type, paper- or varnished-cambric-insulated, lead-covered cable is shown in Fig. 12 and for shielded-type cable in Fig. 13. These joints are insulated with varnished-cambric splicing tape. Note that for shielded-type cable joints, Fig. 13, each individual insulated conductor splice is shielded

by tightly wrapping one layer of copper mesh tape half-lapped completely over the hand-applied tape insulation and spot soldered to the cable shielding tape at each end. These same designs of joints are used for connecting multi-conductor cable at one end to single-conductor cables at the other end.

Fig. 14 and Fig. 15 show the general design of joints for multi-conductor nonmetallic-sheathed cables. The conductor splices are insulated with self-vulcanizing rubber tape. Jute or rubber fillers are placed between the insulated conductors to eliminate voids and to round-out the assembly. The jacket over the insulated conductors also consists of self-vulcanizing tape. Overall protection is provided by two half-lapped layers of friction tape, each layer painted with a good weather-resisting cable paint for



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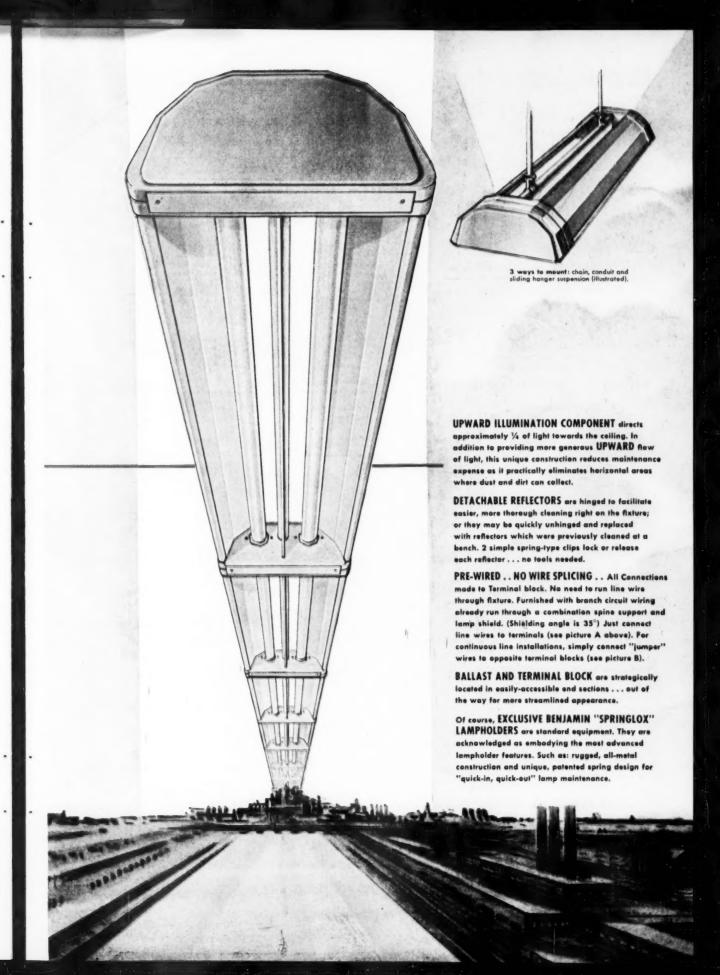
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Plants: New York City 51; Van Wert, Ohio; Los Angeles 22; Hamilton, Canada; Santiago, Chile Offices and distributors in all principal cities

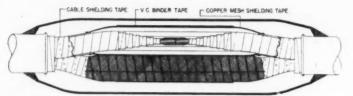


FIG. 13—Straight joint for multi-conductor, shielded-type, paper- or varnished-cambric-insulated, lead-covered cable.

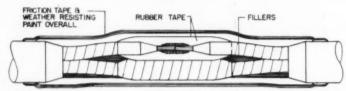


FIG. 14—Straight joint for single-conductor, rubber-insulated, shielded, nonmetallic-sheathed cable.

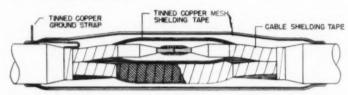


FIG. 15—Straight joint for multi-conductor, rubber-insulated, shielded, non-metallic-sheathed cable.

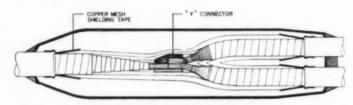


FIG. 16—"Y" joint for single-conductor, paper- or varnished-cambric-insulated, lead-covered cables.

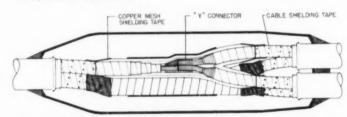


FIG. 17—"Y" joint for multi-conductor, shielded, paper- or varnished-cambric-insulated, lead-covered cables.

shielded cable joints, Fig. 15, the insulated conductor splices are each shielded by tightly wrapping one layer of tinned copper mesh tape, half-lapped, completely across the handapplied tape insulation and spot soldered to the cable shielding tape at each end. A copper strap is soldered to the cable and joint shield of one conductor to provide for connection to ground.

"Y" Joints

When it is required or desired to take a tap off a straight run of singleconductor, lead-covered cable, the

general design of the tap-joint is shown in Fig. 16. This is generally referred to as a "Y" joint but is sometimes called "one-way two-way", "bifurcated", "branch", and other similar descriptions. For service up to 5000 volts inclusive, the copper mesh shielding tape is omitted. Extra care is required to make the wiped joint connection between the lead sleeve and the two cables at one end to prevent leaky or porous wipes. It is general practice to use a "crotch piece" either specially made by the materials supplier, or by cutting to shape from pieces of scrap lead SPEED! SAFETY! EFFICIENCY! ECONOMY!

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- . DOES NEATER, TRIMMER JOB!

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strong bronze U bolts for powerful straight-line pull. Eliminates dead-end tap off wiring. Permits 90° change of cable direction. Fits standard straininsulator eyes.



INSULATING BUSHINGS

Made of high grade laminated phenolic, coated with firm adhesive bond to prevent loosening due to vibration after installation. Ideal for conduits terminating at switchboards, cabinets, pull boxes, motor starters and free pipe terminals.



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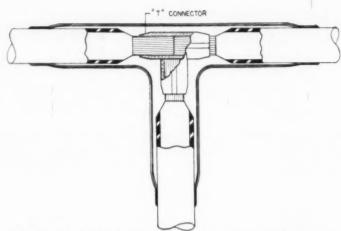
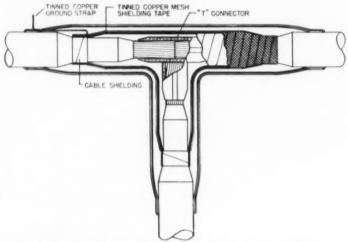


FIG. 18—"T" joint for single-conductor, rubber-insulated, nonshielded, non-metallic-sheathed cables.



sheath. These crotch pieces fill the regular space between the two cables to facilitate solder-wiping.

A tap joint for multi-conductor, shielded, lead-covered cables is shown in Fig. 17. Note that the copper mesh shielding does not completely cover the hand-applied insulation but is terminated at the high point of the wrapped insulation on each conductor. This is because of the difficulty of applying good, tight insulation at the crotch on the tapped cable end, and the copper mesh tape would be a near-source of ground potential. Extreme care is needed to properly insulate the crotch of the splice.

For belted-type cables the copper mesh shielding tape is omitted entirely.

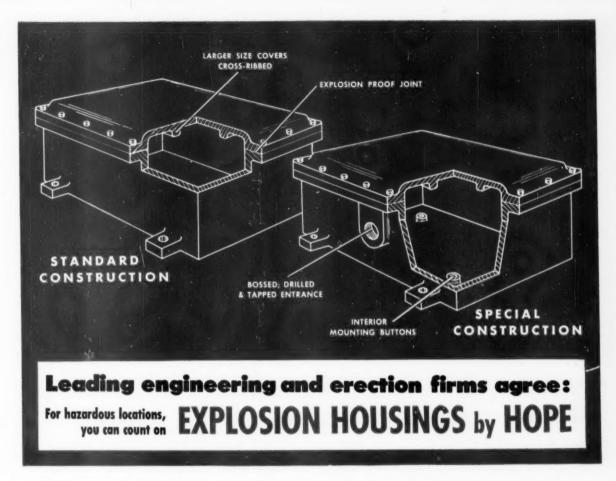
"T" Joints

Right-angle "T" taps cannot be made for lead-covered cable joints due to the impracticability of providing "T" shaped sleeves for covering or housing the joint,

When it is desired or required to make a right-angle 90° tap-off from a straight run of single-conductor, rubber-insulated, nonmetallic-sheathed cable, joint designs such as those shown in Fig. 18 or Fig. 19 are used. This joint is made similar to the straight joints shown in Fig. 10 or Fig. 11—the principal difference being the connector which is designed to receive one conductor at right angles to the main conductor.

For the shielded "T" joint, Fig. 19, note the copper strap for grounding the cable and joint shields.

To tap a main cable and have the tap cable in a position parallel to the main cable, the joint designs are as shown in Fig. 20 and Fig. 21. These are similar to "T" joints, the principal difference being the design of the connector. Care is necessary to assure adequate tight hand-applied in-



FIRST, see how thoroughly Explosion Housings by Hope meet every requirement for installation in Class I, Groups C and D hazardous locations.

Boxes and covers are of extra-strong construction. Covers are cross-ribbed on larger boxes. (Naturally, like all Boxes by Hope, Explosion Housings are of strong, dense cast iron, hot dip galvanized for both service durability and lastingly attractive appearance.)

Precision finished metal-to-metal joints assure explosion-proof construction. Housings have been successfully used as junction and pull boxes and as enclosures in refineries, chemical plants, paint plants, dry cleaning establishments, powder mills and pumping stations.

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You can order special modifications at moderate cost. For instance: entrances can be drilled and tapped to your specifications. Bosses can be supplied to insure five threads on larger-sized conduit holes. Interior blind-tapped mounting buttons can be furnished for safe and easy installation of apparatus or panels. Heavy covers can be provided with bronze hinges.

AND . . . you can order the Explosion Housings you want — standard or with special modifications — through your local electrical distributor!

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and also on our line of hundreds of sizes of weatherproof products: outlet boxes and fittings, iunction and pull boxes, hinged cabinets and junction and pull boxes, write on your letterhead for a terminal boxes—write on your letterhead for a copy of our latest catalog





Quickly form smallradius bends without flattening or kinking. Especially designed to make neat bends for sharp corners, nooks and other close quarters. Saves up to 75% in time and materials on many jobs.

KNOCKOUT PUNCHES

For fast, easy enlarging of knockouts and cutting of holes in metal boxes, cabinets, panels. Various sizes and models for making openings for conduit sizes from ½ up to 3½. To operate, simply turn with a wrench.





HYDRAULIC KNOCKOUT PUNCH

Portable hydraulic unit for driving GREENLEE Knockout Punches. Speeds jobs...easily operated. Develops over

11 tons of pressure so that conduit openings are cut in 10-gauge metal with ease.





Write for new Electrical Tool Folder, Greenlee Tool Co., 1741 Columbia Ave., Rockford, Ill.

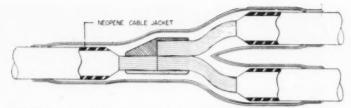


FIG. 20—"Y" joint for single-conductor, rubber-insulated, nonshielded, non-metallic-sheathed cables.

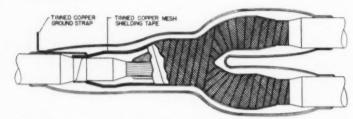


FIG. 21—"Y" joint for single-conductor, rubber-insulated, shielded, non-metallic-sheathed cables.

sulation in the crotch between the two conductors at one end.

Filling Compounds

After the cable is terminated in a pothead or joined inside a lead sleeve, the pothead or lead sleeve must be properly filled with a suitable insulating compound.

Filling compounds serve the following purposes:

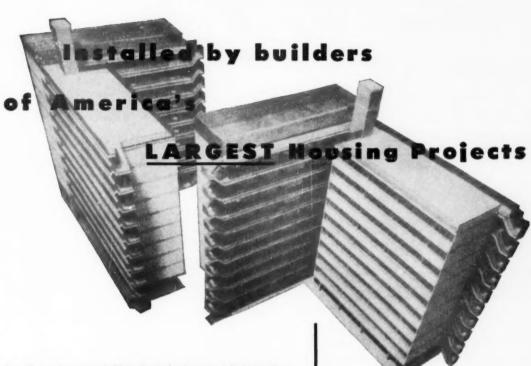
- Eliminate moisture and excessive air pockets inside the pothead or joint.
- On nonshielded joints, serve as an additional insulating medium to withstand electrical stresses around conductors and insulation at cable connections.
- Prevent effects from "breathing action" in potheads and joints during load cycles.
- Form a solid mass in joint housing to reinforce the sleeve against mechanical shock.

They are available in several types depending on the installation, but for the voltage range discussed in this article, are usually of the asphalticbase type. Hard compounds having a relatively high softening point are available for those installations subject to high ambient or operating temperatures. General purpose compound which does not flow at higher than normal operating temperatures or crack at unusually low temperatures is the type most generally used. For best results, the compound should be poured at the temperature recommended by the manufacturer. Compound temperatures should be determined by a thermometer and not by appearance or judgment. Overheating may not only destroy the desirable properties of a compound but may damage the cable or joint insulation. Underheating may not permit the material to properly flow to fill the equipment or to boil out moisture and may also cause voids to form when cooling.

After filling, the pothead (or joint) and compound should be permitted to cool gradually at its normal rate. Accelerated cooling by fans, packing ice around the equipment, etc., are harmful practices which may produce rapid and uneven cooling, causing voids to form which may possibly result in ultimate failure of the installed equipment.



JOB SUPERINTENDENT P. F. Confletti has a broad responsibility in coordinating the electrical installation for Harlan Electric Co., Detroit, at the new Ford Motor Company Research Center in Dearborn.



Yes, all over the country, builders of such developments as Levittown, New York, United Nations Apartments, Long Island, and John Hancock apartments, Boston, used Leviton wiring devices for good reasons.

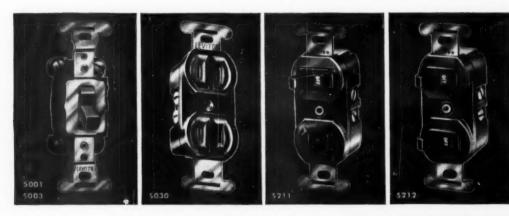
These builders found that Leviton's "5000" line meets all government specifications — FHA, REA and others. They found that the "5000" line provided double contacts, wide plaster ears to make proper alignment faster.

The staked brass binding head screws, with large heads, milled slots, and up-turned terminal lugs made wiring easier and positive. Cups made of heavy, sectioned and ribbed Bakelite assured satisfaction in heavy duty performance.

LEVITON

5000 line wiring devices

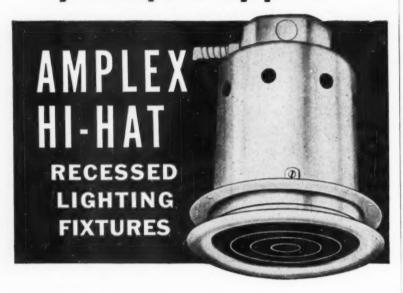
For quality's sake . . . make your next installation LEVITON!



LEVITON MANUFACTURING COMPANY

main plants and office: Brooklyn 22, New York warehouses in: Chicago, Ill. and Los Angeles, Cal. offices located in all principal cities

Finest Hi-Hats on the market... yet competitively priced!



WHEN YOU'RE PLANNING new recessed lighting, be sure to see Amplex Hi-Hats. Just put one of these lighting units alongside any other and you'll insist on Amplex. It's the best looking fixture on the market…looks best because it is best, in design, construction and finish.

Amplex Hi-Hat has a permanent deluxe satin aluminum finish, inside and out...a rolled flanged edge for extra strength and better ceiling fit. The can is deep-drawn to provide uniform thickness and a smooth surface...plaster ring is keyed for perfect aligning...improved louver is more efficient; won't drop out. And on top of all this, Amplex Hi-Hats are today's best dollar value.

Amplex Hi-Hats, Swivelites and Focalites give you an accent lighting line that meets every display requirement and saves real money. Write for the full story about to-day's fastest-growing line. Amplex Corporation, Dept. C-1 111 Water St., Brooklyn 1, N. Y.



Sealed-Beam Reflector Lomps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.

BANKED TRANSFORMERS

[FROM PAGE 105]

Should a breakdown of a three-unit assembly ever occur (the possibility of which is remote), replacement of one single-phase unit would be faster and less expensive than obtaining a 3-phase replacement. In other words, derangement of service would be lessened. Moreover, if a replacement were *not* available, it would be possible to maintain operation (admittedly, only at 57%) by removing the defective unit and reconnecting the remaining two units open-delta.

Units are dry type cooled by the normal circulation of dry air, thereby making maintenance negligible. There is no liquid to replace, no fans to lubricate, no valves or gaskets to check for leaks, no gauges to read. Fireproof vaults are unnecessary.

Insulation of transformers being Class B, an 80° C temperature rise is permitted; a factor resulting in increased output without adding to either size or weight. And, lastly, the units are neat in appearance, efficient in operation and economical in performance.

Underfloor Modification

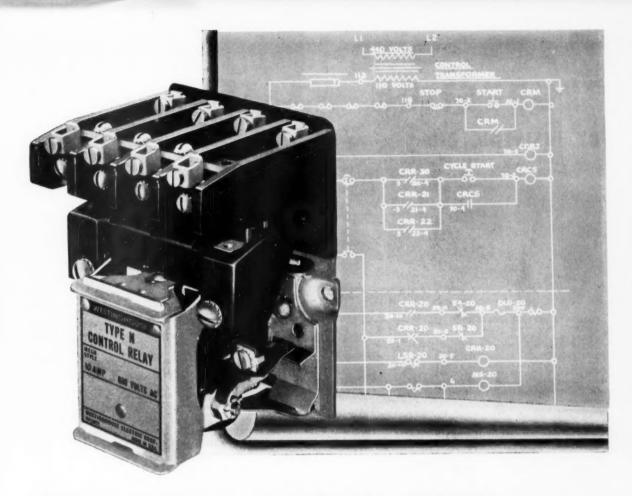
The second innovation dictated by limitations is the modified underfloor duct system adapted for use in the 9½-inch floor slabs which were selected when it became apparent that steel beam construction was impossible.

To raise junction boxes and ducts above slab reinforcing rods, special 6½-inch bolts were used to support the adjustable saddles. Also, so as to keep ducts within the center half of the slab and thereby safeguard slab bending moments, special 2½-inch collars were designed by the duct manufacturer (NEPCO) for all inserts and boxes. This practical solution was one of several adaptations suggested by Foss' superintendent Bert Naylor.

The system is a standard twin-duct installation with outlets on 2-foot centers. Parallel runs average 6 feet centerline to centerline, with junction boxes and cross duct runs located every 40 feet.

Over 6 miles of ducts are so installed, providing four floors of office space with a flexible system for local power, telephone and signal service.

In addition to this duct installation, wiring is also carried through rigid conduit (feeders, risers and ground floor slabs), flexible conduit (to con-



NEW! TYPE N CONTROL RELAY

Rugged • Compact • Versatile

Designed into the new Westinghouse Type N Relay are all the outstanding features of the Life-Linestarter. Here are a few of many top advantages you get:

Knife-edge bearing for minimum wear

Kick-out spring for rapid, positive operation

Simplicity of design for longer life

The relay's compact design saves critical mounting area, whether in multiple-unit panels, in combination enclosures or singly in machinery.

Contacts may be easily converted from Normally Open to Normally Closed in the field.

The Type N Relay is rated 10 amperes (open), and is available in any pole combination up to 6 poles;

can be supplied for any voltage up to 600 volts a-c and either open or in standard NEMA enclosures.

Westinghouse offers you a full line of control to handle competently the simplest or most complex control requirements.

Let us work with you. Call your Westinghouse Representative or write for B-5817. Westinghouse Electric Corp., Box 868, Pittsburgh 30, Pa.



STOP THIS TYPE OF PRODUCTION WASTE



ELIMINATE OVER-PROTECTION→

Problem: Motors are overloaded because of fuses with excessive time lags.

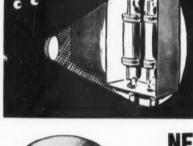
Cure: Ask for Monarch Fuses with the exclusive Mon-O-Lag link. It provides the necessary lag for temporary overloads, yet full protection on continued shorts.



←STOP UNDER-PROTECTION

Problem: Costly power failures result from faulty fuses that burn out at below the specified load.

Cure: Specify Monarch Fuses with the advanced design that keeps the fuse cooler, tighter and in true alignment. Underwriters Laboratory approved.



NEW FIN SURFACES MAKE MONARCH Renewable FUSES EVEN COOLER OPERATING

Another example of Monarch's advanced design. These heat dissipating, brass fins both support the fibre bar . . . and conduct away excess heat. Cooler fuses and longer fuse life are the result. Available, at present, in 600 amp-250 volt; 400 and 600 amp-600 volt sizes. Call your distributor, or



WRITE FOR BULLETIN NO. 25



nect lighting fixtures in hung ceilings and motors where vibration or movement are possibilities), EMT (with screw type connectors, couplings and fittings), and auxiliary rectangular metal gutters and raceways (at transformer and control panel points). 2000-amp 3-wire busduct is installed to carry 480-volt current between the main switchboard and utility vault.

All raceways are secured to cabinets, terminals and pull boxes by means of double locknuts.

Where conduits are installed exposed, along the basement ceiling. they are supported by rod hangers suspended from concrete inserts, horizontal saddle bars and pipe clamps.

Wire for lighting and power runs from No. 12 AWG to 500 MCM, generally Type R in dry locations, Type TW in damp locations or when installed in concrete slabs or underground. All main feeders and branch circuits are identified by color coding as well as by linen tags marked by indelible ink.

Short Panel Take-offs

The positioning of lighting panels immediately adjacent to riser shafts is still another indication of analytical planning, because take-off cables are thereby shortened to a minimum, conservation of copper is at a maximum and voltge drop between riser and control points is negligible.

Take-offs are made through Bakelite-enclosed Penn-Union cable taps. with take-off cables running parallel to the main risers for a very short distance, then sweeping directly into the panel gutters. The design of the cable taps also speeds this operation, for the insulation of the riser is removed for only a few inches, the split halves of the tap placed around the riser, the end of the take-off cable inserted into the tap, and the halves secured by means of recessed hex-head bolts. The Bakelite covers are then placed around the tap and likewise bolted, thoroughly insulating a compact, neat, rapidly-effected junction.

In connection with the P-A system. large speakers are mounted at frequent intervals in the ceiling, concealed above the acoustical ceiling panels, yet readily accessible for servicing. Contrary to normal assumption, voice and musical rendition is excellent and easy understanding is possible with low-volume output.

In connection with the lighting, fixtures in the office areas are functional. while several variations of cove illumination are utilized in the lobby and other public areas.

Solve Distribution Problems With SORGEL Substations and Power Centers

"Packaged" Units for Indoor Installations

Speeds Expansion and Earlier Production. The complete Substation is shipped in one or more factory-assembled units, on a substantial steel base, completely wired and tested, ready for installation and final connection. No need of buying separately the transformers, switches, fuses, insulators, circuit breakers, and other accessories, and then assembling and connecting them on the job.

Lower Maintenance Costs. Because dry-type transformers are used there is no liquid to check, replenish or replace. No fire hazard. All parts are easily accessible.

Flexibility for Future Conditions. Being all selfcontained in a single unit, the Substation can be readily moved from one location to another. Saves Copper. The Substation can be placed near the load center, so that shorter secondary cables and small primary lines can be used. Improved voltage regulation and reduced line drop.

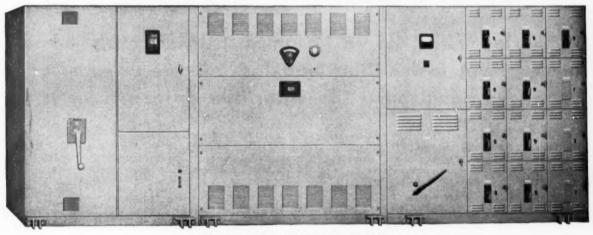
Reduces Costly Power Interruption. By locating the Substation at or near the load center, it restricts the power interruption to that area. Other areas, not affected, can continue operation.

Years of Continuous Hard Service. The rugged construction, liberal design, expert craftsmanship, sound engineering, all embodied in SORGEL Dry-type transformers, have given years of continuous hard service.

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Not necessary to design or change your installation to fit a "standard"

Sizes up to 3000 Kv-a. All voltages up to 15 KV.



2000 Kv-a., 3-phase, 13,200 volt unit Sub-Station With forced draft fans, automatically controlled by temperature indicator to increase transformer capacity $331/_3\%$; primary fused load breek switch and kilowatt-hour meter, secondary voltmeter and drawout circuit breakers.

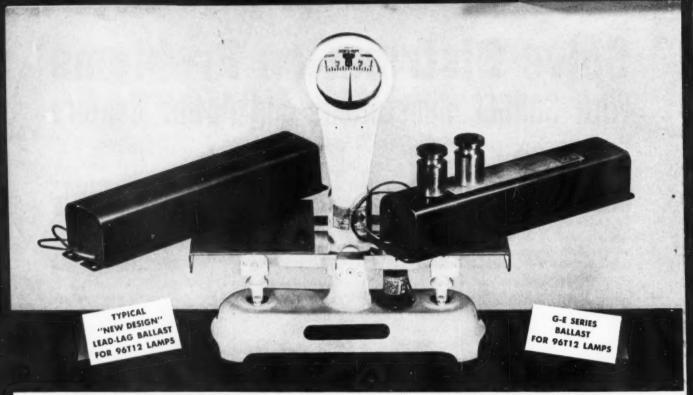
Also a Complete Line of Conventional Air-Cooled Dry-Type Transformers

1/4 to 3000 Kv-a. Single phase and poly-phase. 120-240-480-600 volts.

Sales Engineers in Principal Cities

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Pioneers in the development and manufacturing of Air-Cooled Dry-Type Transformers-Over 35 years



G-E SERIES BALLAST WEIGHS LESS than lead-lag ballast of comparable quality, for 96T12 lamps. Above, G-E ballast is two pounds

lighter than typical lead-lag ballast. Series design requires fewer materials, gives lower weight, cost, at no reduction in quality.

Series or lead-lag ballasts for

G-E Series Ballast for 96T12 lamps costs less, weighs less, has lower power losses than lead-lag ballasts of same quality; also gives equal lamp life with little difference in "strobe"

Both G-E series ballasts and so-called "new design" lead-lag ballasts for 96T12 lamps assure full rated lamp life, have comparable lamp replacement costs, and provide approximately the same stroboscopic correction.

For 96T12 lighting applications, the G-E series ballast will use less materials and will weigh less; will have lower losses and lower power consumption; and will provide lower cost lighting than a lead-lag ballast of comparable quality.

The reason is simple. The series ballast more efficiently starts and operates the lamps because they are started in sequence rather than simultaneously. Therefore, fewer materials are needed, and a lighter, less costly ballast results.

If a lead-lag ballast approaches a series ballast in active

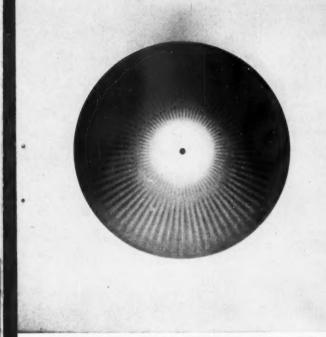
material utilization as well as weight, it must almost certainly give poorer lamp performance. Why? Because such reductions are made at the cost of lamp current, giving less light per fixture. This means that more fixtures would be necessary to achieve the same total light level.

A MATTER OF ECONOMICS

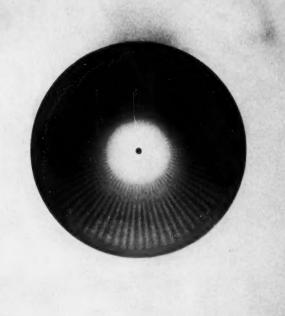
General Electric makes more ballasts of all types, including those with lead-lag circuits, than any other manufacturer. G-E research engineers consider every important factor for each type of ballast. In ballast design, other things being equal, the biggest single factor is highest practical quality at lowest cost. That's why General Electric recommends series instead of lead-lag ballast for 96T12 lamps.

GET <u>FULL</u> INFORMATION—complete details on comparisons between series and lead-lag ballasts for 96T12 lamps are in bulletin GEA-5909. Write Section B 412-103, General Electric Company, Schenectady 5, New York.





NO APPRECIABLE "STROBE" DIFFERENCE with either G-E series ballast (left) or "new design" lead-lag ballast (right). Both



pictures were taken under identical conditions: disc spinning at exactly 100 rpm, illuminated by same two 96T12 lamps.

96T12 lamps? Here are the facts:

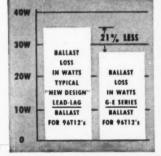


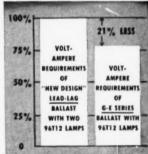
EQUAL MAINTENANCE TIME is taken in replacing lamps, whether series or lead-lag ballast is used. Time is spent in moving ladder and climbing up, not in few seconds taken to change lamps.



OBE" DISC, left, for testing 96T12 lamps is black nounted on 100 rpm motor. Right: disc spinning

STATIONARY "STROBE" DISC, left, for testing 96T12 lamps is black with white lines, mounted on 100 rpm motor. Right: disc spinning at 100 rpm in daylight shows no lines—or zero "strobe."





LESS POWER CONSUMPTION, inherent to G-E series ballast, is shown in left chart, above. Right: series ballast must be smaller, lighter, as weight and size are about proportional to volt-amperes.

STOP annoying blink...blink...blink



WITH WATCH DOG NO-BLINK FLUORESCENT STARTERS

Annoying fluorescent blink and excessive maintenance go hand in hand. Here's what Watch Dog* starters do about it.

- Watch Dog starters stop blinking by automatically turning off a failing fluorescent lamp.
- Watch Dog starters keep the lamp off until the red reset button is pushed when new lamp is installed. No recurring blinking every time the lights are turned on.
- Watch Dog no-blink starters outlast ordinary starters by as much as 10 to 1. Ballasts last longer, too.

You can stop the annoying blink of worn-out fluorescent lamps—cut starter replacement costs-cut ballast replacement costs-by seeing that all your fluorescent fixtures are equipped with General Electric Watch Dog no-blink

Specify Watch Dog starters for new fixtures-insist on them for replacement. For a copy of folder Q33-118, which gives all the facts on the Watch Dog starter line, write Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Registered Trade-mark General Electric Company

You can put your confidence in_



GENERAL (SE) ELECTRIC

For all replacement needs-use the famous Watch Dog no-blink starter with the red reset button.



And here is the tag to look for when you buy fluorescent fix-

tures. It is your guarantee that the fixture has been equipped with G-E Watch Dog no-blink starters.

Product News

Pressure Connected Wiring Device

(1)

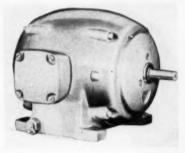
A new method of making electrical connections on flush-mounted wiring devices eliminates screw terminals. The new devices can be wired by pushing No. 14, 12 or 10 conductors stripped back 1 inch into holes in the back of the device. A unique pressure lock terminal holds the entire stripped length of the wire lead against a contact plate with a grip that will withstand a pullout test of over 75 pounds for No. 14 Awg wire. Equally firm, positive electrical and mechanical connections are obtained with Nos. 10 and 12 wires. Connections are fully insulated since they are totally enclosed in the device housing. There are no exposed stripped wires or terminals. If necessary, wires can be released from the terminals by pressing a small screwdriver into "release" slots. Devices are designed to fit standard outlet boxes and to take standard wall plates, and when installed are similar in appearance to conventional devices.

In addition to tests of strength and durability conducted by Underwriters' Laboratories, Inc. and by General Electric, tests of wired samples of the new devices have passed the corrosion, vibration and thermocycle tests usually specified only for aircraft electrical connectors. Field tests have also been made by electrical contractors in Cleveland, Pittsburgh, Providence, San Francisco, and

Rochester

This pressure lock method of termination represents a development under the leadership of G. B. Benander, a General Electric Company managing engineer. Benander's new method of termination will be designed into a complete line of wiring devices in addition to the outlet and switch currently announced. The devices are listed by Underwriters' Laboratories, Inc., and are available in brown or ivory plastics. The duplex plug receptacle is rated 15 amp 125 volts, and 10 amp 250 volts; the switch is T-rated 10 amp 125 volts and 5 amp 250 volts.

General Electric Company, Bridgeport,



Motor

(4)

A new totally-enclosed motor, designated as Type SS. It is designed for services where dampness, dust, fire hazards and corrosive fumes are prevalent. Type SS is self-cooling. Smooth exterior lends itself to wiping off or hosing down. Type SS is also provided with a slinger to protect output shaft bearing against entrance of dirt or water. This motor, also available in Type SES, has been approved for explosion-proof service in hazardous locations by Underwriters' Laboratories, Inc. Available in a range from 1/1 to 2 hp, also fan-cooled to 75 hp. Complying to NEMA standards, Types SS and SES have these additional features: modern exterior design; sealed terminal chamber; normalized castings; asbestos-protected windings; solid centricast rotor and Lubriflush bearings.

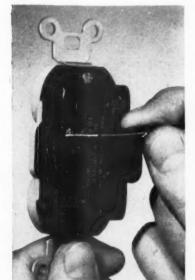
U. S. Electrical Motors, Inc., Box 2058, Terminal Annex, Los Angeles 54, Calif.



Fluorescent Fixture

A new surface-mounted fixture known as the Skylighter. Units are available in 2- by 2-ft, 2- by 4-ft, 3- by 3-ft, 3- by 6-ft, 4- by 4-ft, and 4- by 8-ft. sizes. They may be used single, or mounted side by side or end to end to form a variety of patterns, or to provide a complete ceiling of light. Bottom panel consists of injection-moulded plastic louver (40° by 40° shielding), hinged to swing down for maintenance. For use in department stores and other high-ceilinged interiors requiring large amounts of light.

Leader Electric Company, 3500 N. Kedzie Ave., Chicago 18, III.



Insulating Compound

A new putty-like electrical insulating compound that comes in a roll and applies like tape. Designated "Scotchfil" brand electrical insulation putty, the black, 1/8inch-thick material fuses into a void-free mass after application. It is designed not only to insulate, but also to pad sharp edges as on bus bars, build up cable splices, and fill voids around irregularshaped connectors prior to taping. As the material is used, the liner is stripped off, and the insulating putty is molded into place with the fingers. It is used with "Scotch" brand plastic electrical tapes Nos. 22 and 33 since the backing and adhesive of these tapes form an inseparable bond with the material.

has a dielectric strength of 350 volts per mil.

Minnesota Mining and Manufacturing Co., 900 Faquier St., St. Paul, Minn.

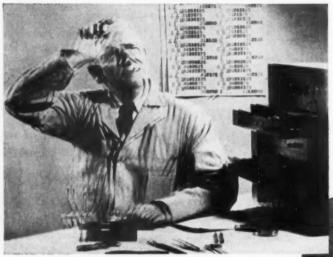


Pipe and Conduit Reamer

The new Ridgid spiral 2-S pipe reamer has been added to this line of pipe tools. Spiral reamer cuts inside burr from pipe and conduit clean and fast with minimum effort or pressure. Long tool life is assured by high quality tool-steel construction. Reamer cuts holes in sheet metal also. Reamer capacity: ½-in. to 2-in. Furnished with ratchet handle, or spiral reamer unit alone, for use in ratchet handle of Ridgid No. 00R threader.

Ridge Tool Company, Elyria, Ohio.

STOP annoying blink...blink...blink



WITH WATCH DOG NO-BLINK FLUORESCENT STARTERS

Annoying fluorescent blink and excessive maintenance go hand in hand. Here's what Watch Dog* starters do about it.

- · Watch Dog starters stop blinking by automatically turning off a failing fluorescent lamp.
- Watch Dog starters keep the lamp off until the red reset button is pushed when new lamp is installed. No recurring blinking every time the lights are turned on.
- Watch Dog no-blink starters outlast ordinary starters by as much as 10 to 1. Ballasts last longer, too.

You can stop the annoying blink of worn-out fluorescent lamps-cut starter replacement costs-cut ballast replacement costs-by seeing that all your fluorescent fixtures are equipped with General Electric Watch Dog no-blink starters.

Specify Watch Dog starters for new fixtures-insist on them for replacement. For a copy of folder Q33-118, which gives all the facts on the Watch Dog starter line, write Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Registered Trade-mark General Electric Company

You can put your confidence in_

GENERAL (ELECTRIC



For all replacement needs—use the famous Watch Dog no-blink starter with the red reset button.



And here is the tag to look for when you buy fluorescent fix-

tures. It is your guarantee that the fixture has been equipped with G-E Watch Dog no-blink starters.

Product News

Pressure Connected Wiring Device

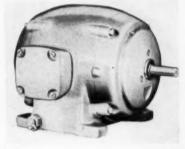
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U. S. Electrical Motors, Inc., Box 2058, Terminal Annex, Los Angeles 54, Calif.

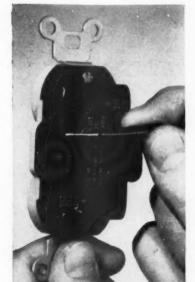


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Minnesota Mining and Manufacturing Co., 900 Faquier St., St. Paul, Minn.



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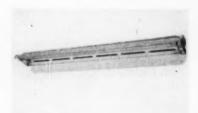
Ridge Tool Company, Elyria, Ohio.



DOUBLING IN BRASS...

Midwest Electric Mfq. Company

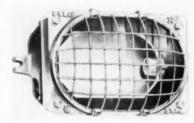
Obicago 12, Illinois



Industrial Luminaire

An industrial luminaire, type SDP, which provides more comfortable seeing conditions by means of an upward component. It uses two slimline lamps of 38, 58, or 75 watts each. The upward component, which distributes 23% of the light towards the ceiling, eliminates the severe contrast between bright luminaires and dark ceiling. The luminaire provides the upward component by slots located over the lamps on each side of the reflector. It uses the new lead-lag slimline Back to back lamp spacing is provided, and adjustable slide action hangers are available. Also available is a longitudinal shield to provide 27° shield-

Westinghouse Electric Corporation, Pittsburgh 30, Pa.



Floodlight

A rectangular vaporproof floodlight, designated Type 1570 pit and subway light. It is especially designed for recessed or surface mounting in the walls or ceilings of maintenance pits, underpasses, tunnels, subways, and other locations subject to heavy moisture. Reflector can be pivoted to adjust angle of beam 18° upward or downward from center. Heat and impact resisting front glass is plain. Drainage slots are provided on cover to avoid standing water. Hinged, heavy wire guards are optional.

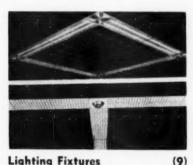
Pyle-National Company, 1334 North Kostner Ave., Chicago 51, Ill.

Converter System

A community Antenaplex converter system, designed to improve reception quality of community Antenaplex sys-tems by converting all VHF television channels to be received above Channel 6 to the lower frequencies, usually Channels 2, 4, or 6. The new system, which will be assembled for each installation, will enable community Antenaplex systems to provide maximum-fidelity reception over the full six-megacycle band by

utilizing channels which have lower cable transmission losses than Channels 7 to 13. The new converter system receives the incoming signal from the preamplifiers of the Antenaplex system's tower amplifier, and the outgoing signal from the converter is then transmitted back into the appropriate output strip amplifiers of the tower amplifier. The equipment, with its own incorporated power supply, will be supplied with a cabinet for wall mounting near the tower amplifier. Input and output connections of the plug-in type will be used for ease of installation in the community system.

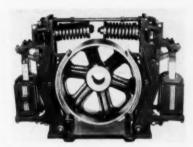
RCA Victor Division, Radio Corporation of America, Camden, N. J.



Lighting Fixtures

A new line of commercial-type fluorescent lighting fixtures of different lengths which can be joined to give appearance of a continuous sweep of light. The new recessed troffer line consists of one-, two- and three-lamp fixtures available with six different types of shielding and four incandescent spotlight fixtures. New series was designed to provide an almost endless variety of lighting combinations to fit all shapes and sizes of stores, schools and offices. Composed of lengths ranging from two feet to eight feet for single mounting or any desired length for continuous rows, these fixtures were specifically engineered for installation in shallow ceiling areas. Six different types of shieldings are available. Among these is the 45° by 45° louver shielding which gives a high level of illumination with a minimum of shadows and glare. Four types of glass shieldings (albalite, twinlite, curved lens and curved albalite) Plastic shielding is often used where protection against breakage is desired. Four incandescent spotlight fixtures have also been introduced. These "corner boxes" are available with matching-ribbed albalite glass, concentric-ring louver shielding, concentrator-type molded-glass lens, and rotating spot for high-lighting of specific areas or displays and permit the adaptation of matching recessed troffer fixtures. Fluorescent fixtures are available with either standard start or instant start lamps while louver and directional incandescent spotlights are designed for use with 150-watt PAR-38 lamps and the albalite and glass lens incandescent spotlights utilize 100-150-watt inside frost lamps

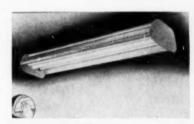
Sylvania Electric Products, Inc., 1740 Broadway, New York, N. Y.



Solenoid Shoe Brake

The Trombetta line of solenoid operated shoe brakes include capacities ranging from three to 24,000 ft.-lbs; available in standard, oil immersed and explosionproof types. Brake design features four sets of springs, two solenoids and one torque tie bolt connecting two practically independent operating units-one for each brake shoe. Brake shoes are mounted to shoe supporting arms by a ball and socket pin permitting precise adjustment to wheel. Unit has anti-toeing devices. Spring design and mounting permit very fine torque adjustment. Brake is operated by two long-stroke solenoids, each of which can operate brake alone so one solenoid can be used as a spare. A bad solenoid can be removed and replaced by a dummy weight in short time. Brakes have relatively small wheel with long wheel face to radiate heat; are easy to maintain. Units available for ac operation and holding; ac operation and dc holding; or dc operation and dc holding. Brakes may be equipped with auxiliary cut-out switch to decrease solenoid current after solenoid plunger has moved into sealed position. Variation of unit available with one solenoid.

Trombetta Solenoid Corp., 331 N. Milwankee St., Milwankee 2, Wis.



Fluorescent Fixture

(11)

Flexoliter, a new idea in fluorescent fixtures in which the reflectors can be moved by a flick of the finger to any number of positions, directing the flow of light accordingly. It was developed primarily for industrial application to prevent glare in workers' eyes while focusing light on work. The flexible steel reflectors have five positions, regular 100% down; uplight, 20% up and 80% down, glare shielding 40% up and 60% down, semidirect, 50% up and 50% down; indirect, 100% up. Fixture is made for both 20 watt and 40 watt lamps. It is made of 20 gauge steel, finished in white oven-baked enamel.

Duro-Test Corporation, North Bergen,



ENGINEERED



• One piece NailKlip. Faster, firmer method of clamping cable and tubing. Entrance cable sizes 8-3 to 2-3. Armored and non-metallic sheathed cable sizes 14-3 to 10-2.

Send for FREE Samples



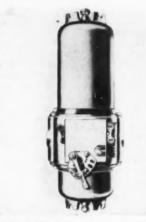
Ask your wholesaler for complete information on all JIFFY products listed below

Adjustable Bar Hangers
Thinwall Straps
Outlet Box Covers
Snap-In Blanks
Wire Lubricant
Porcelain Insulators
Boring Attachment
Conduit Bender Vise
Adjustable Metal Hole
Cutters

Staples
Pipe Straps
Box Supports
Fish Tape
Line-Up Washers
House Brackets
Solder Dipper
Saw Attachment
Nails



CLYDE W. LINT 2323 W. 18th St. Chicago 8, III.



Motor Controls

(12)

Seven new improvements have been incorporated in type EPC explosion-proof line starter and circuit breaker Condulets. The new design is known as Model M52. Features are built-in pushbutton stations: built-in selector switches; additional back conduit entrance; additional horizontal through feed conduit entrances; new and improved reset mechanism: Neoprene gasket for protection of upper cover joint in severe weather conditions; and increased wiring space. Threaded joint construction throughout results in safety, ease of maintenance and inspection, and corrosion protection. High density aluminum alloy castings and sectionalized construction permit even size 4 starter in combination with 200-ampere circuit breaker to be installed by an electrician and helper without any lifting equipment. Smaller sizes may be installed by one man with ease. Type EPC Condulets are available for all sizes of line starters and combinations up to size 4, and for circuit breakers alone up to 600 amperes.

Crouse-Hinds Company, Syracuse 1, N. V.



Batteries

(13)

A new line of two-cell and three-cell industrial batteries in transparent plastic containers for stationary small power applications. Known as the Exide-Tytex, Type COE, the battery is designed to eliminate the need for cumbersome wood trays and their inherent cleaning prob-

lems, and to allow complete flexibility of installation, using standardized interunit connectors. Batteries are equipped with colored pilot balls which indicate at a glance the state of charge. Solution level lines marked on the containers show recommended upper and lower levels of electrolyte. Unbreakable, sprayproof vent plugs keep out dust or other foreign matter. The two-cell units are made in both end-to-end and side-to-side assemblies, while the three-cell batteries are available only in side-to-side assemblies. Width and height of the end-to-end units have been standardized at 8 and 81/2 inches, respectively, while corresponding dimensions of side-to-side assemblies have been standardized at 41/4 and 81/2 inches. Electric Storage Battery Company, Philadelphia, Pa.



Ceiling Luminaires

(14)

A new series of fluorescent ceiling fixtures known as "Gar-See-Lite". They are of the general-diffuse type, providing approximately 50% direct and 50% indirect light distribution. Both 2-lamp and 4-lamp units are available for standard fluorescent or slimline lamps. There is also a choice of sidepanels—plastic, metal or illuminated metal. Design provides for easy cleaning and re-lamping. Louvers are lowered by releasing spring catch at either or both ends. A 14-inch drop chain supports louver in lowered position.

Garden City Plating & Mfg. Co., 1750 N. Ashland Ave., Chicago 22, Ill.

Precipitron

(15)

A completely redesigned Precipitron oil mist control unit that will recover the coolant oil from the mist and smoke generated by high speed cutting, grinding, milling, and similar machining operations. Available in two models: Type PO-6 and PO-12. Unit is completely self contained: the sheet steel cabinet houses the all aluminum oil-particle charging and collecting elements with their high voltage power pack; motor driven fan; duct connection; and oil sump. Fan motors are three-phase, fractional hp, ball bearing, pre-lubricated, totally enclosed, for 220 or 440 volt service. Power pack operates from a single phase, 115 volt line and consumes less than 60 watts when operat-

Westinghouse Sturtevant Division, 200 Readville St., Hyde Park, Boston 36, Mass



New G-E Motor Control Center Has Easiest-to-Interchange Units

The new General Electric motor control center is the most up-to-date equipment for the centralized control of a-c motors up to 200 horsepower. Each control center is planned for the job it is to handle, but it can rapidly be modified to meet changed requirements. Standard units can be easily interchanged or substituted, new units can be quickly added. Units may be mounted back-to-back in same standard enclosure. Master terminal boards may be located at either top or bottom of cabinet.

ACCESSIBLE. Installation is simple -just a matter of sliding the unit into its compartment. Stab-on connectors grab the vertical bus. Wiring is easy because even pushbuttons and terminals are mounted on the unit frame for simple front-connecting. Doors swing more than 90°, so unit can be lifted out of compartment for accessibility from all sides. Barriers between units can be slipped out. making a four-inch wiring trough. Master terminal boards can be swung out of place for connecting without "fishing" of wires.

FOR MORE INFORMATION, contact your nearby General Electric apparatus sales office, authorized G-E agent or distributor, or write Section 781-1 for GEA-4979A today. General Electric Company, Schenectady 5,



INDIVIDUALLY PLANNED motor control centers are manufactured and delivered completely wired and ready-to-install from this new General Electric motor control center production line.



EASY TO INSTALL, inspect, and interchange starters, which are assembled as complete units, including pushbuttons and wiring terminals for easy front-connecting. Door swings more than 90°



HIGH-POTENTIAL TESTS are made of each completed General Electric control center before shipment, to assure adequate short-circuit protection, safety for plant personnel and equipment.

You can put your confidence in_

GENERAL & ELECTRIC







BRANDED JACKETS!
No mistake . . . You know you are getting Certified. You read at a glance cable type, size, voltage, "P116BM". . . which indicates approval by the Pennsylvania Bureau of Mines, and acceptance for listing by the U.S. Bureau of Mines. Easy to measure . . "Bronco" is repeated every 2 feet.

With Bronco 60 Certified you know you are getting a full 60% by weight of Neoprene in your cable's protecting jacket because its contents are certified.

More Neoprene makes long-lasting Bronco 60 Certified more resistant to oil, acids, alkalis, ozone, gasoline, salt water.

In addition, with Bronco 60 Certified you get: 1. Cold Rubber Insulation. 2. Branded Jackets.
3. Superior Flexibility.

So, BE CERTAIN, GET CERTIFIED

— the greatest cord value on the
market!





Safety Switch

(16)

A new 200-ampere, 600 volt, fusible and no-fuse front-operated HCI safety switch. Added to the 30-, 60-, and 100ampere smaller switches, the new jumbo model rounds out the HCI line to fill 90% of all industrial heavy duty safety switch needs. Now standard equipment on all HCI switches is a felt gasket which blocks dust and dirt in the same manner that weather stripping stops drafts. The unique design of switch makes it dustresistant and it is free from direct openings to the interior. It interrupts heavy loads quickly and cleanly. The arc-quenching action of the switch is patterned after the arc-interrupting principle of modern circuit breakers. Grid pins break up the arc, divide it into a series of smaller arcs, and dissipate the

Trumbull Electric Department, General Electric Co., Plainville, Conn.



Water Cooling Unit

(17)

A new type of self-contained water cooling unit designed for complete inthe-wall mounting. It is a combination of the Filtrine Wal-Pak with any Crane wall drinking fountain. Featuring chilled water without exposed machine or pipe. the new unit also eliminates uncleanable recesses since it has only a flush-with wall louvered panel as visible evidence of the chilled water source. Available in models for one and two fountain service, it is small enough to recess completely in most building partitions. A separate, remov-able louvered panel gives full access to the cooling unit and compressor which are factory packaged on a welded anglechassis with all electrical and plumbing connections located for fast installation within the wall aperture.

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.

Insulating Tape

(18)

A new, self-bonding electrical insulating tape, designated as Bi-Seal Type V. This tape has all the characteristics of the original Bi-Seal patented tape, but with greatly increased abrasion resistance, tensile, and dielectric strength (over 1,000 volts per mil). It is ideally suited to wire and cable splicing, as it affords such advantages as: water, acid, alkali, corrosion and weather-proofness. It is impervious to ozone and oxygen. Type V is a self-bonding, polyethylene based compound that fuses into a solid homogeneous mass when applied. It can be applied at temperatures as low as minus 40°F and does not become brittle or difficult to use at sub-zero temperatures. It is UL approved as a splice insulation for rubber and thermo-plastic insulated wires and cables when temperatures do not exceed 80°C and when covered with friction tape. Type V is available in standard widths of 1/2-, 3/4-, and 1-in., .020-in. thick, in 30 foot rolls, clear or black.

Bishop Manufacturing Corp., Cedar Grove, N. J.



Automatic Chuck (19)

power-operated automatic A new chuck which threads, reams and cuts four-inch pipe in 44 seconds. For pipe in sizes of 2½-in, 3-in., 3½-in. and 4-in, the Thred-O-Matic "44" is equipped with die heads. Adapters are available to handle 1/2-in. to 2-in. pipe. It has an exclusive power-operated automatic chuck and multi-speed transmission. It has eight hobbed jaws, four in front and four in rear, which grip pipe tighter as the torque is applied. The auto-type transmission has four speeds forward and reverse, coupled with the two-speed motor, giving eight speeds forward. The operator has positive control of threading operation at all times. Cutter mounted on front jaw housing allows the operator to place fitting on pipe immediately after treading. Cutter is removable for short nipples. The two-speed, three hp motor operates on a 220 volt, 50-60 cycle.

Quijada Tool Division, Gaines-Collins, 5474 Alhambra Ave., Los Angeles 32.

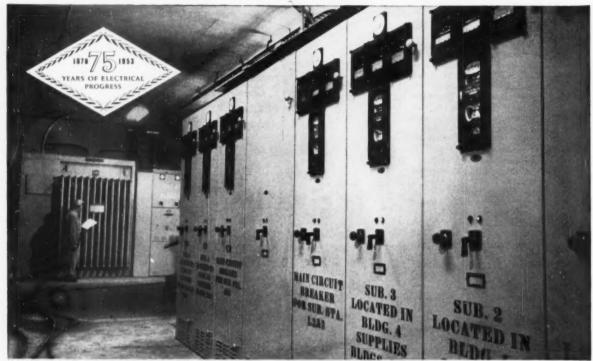
Measure current instantly without shutting down equipment or making ammeter connections!

Save costly man-hours by carrying this pocketsize tool on every call. Balance loads, locate grounds, trace shorts. Determine load conditions.

Check motor overloads, start and run current, relay settings. Check open windings in motors, check out controllers, check voltage losses, etc.

Remember, "you're the doctor" when you walk in with an Amprobe.





KAISER-FRAZER selects G-E metal-clad switchgear to power modernized parts plant. Increased safety, protection against power shut-downs are provided by this 8-compartment, 4.16-kv

lineup. Switchgear has two incoming line sections, tie breaker, five feeders—each feeding a 1000-kva load center, such as Substation No. 4 in background.

Kaiser-Frazer installs one of the most



EASILY installed armored cable, in center, replaces maze of old low-voltage cables at right—saves tons of copper.



TOOL ROOM shows interlocked armor cable leading to junction box, Trumbull Flex-A-Power* bus duct with plug-in connections.



FOR SWITCHGEAR CONNECTIONS, 700 feet of interlocked armor cable were pulled into position in 45 minutes. Cable can go under, over pipes, rafters, beams.



G-E UNIT SUBSTATION, one of five 1000-kva Pyranol* 4160-480Y/277 load centers in Kaiser-Frazer plant, powers nearby machines. Rail protects substation from battering of trucks.

modern plant power systems in America

New G-E metal-clad switchgear and radial load-center distribution system replace obsolete low-voltage system

In modernizing a factory in Dowagiac, Mich., for use as a parts plant, Kaiser-Frazer Company turned to General Electric for a complete electrical job.

A very important phase was the G-E engineered distribution system, installed by Koontz-Wagner Electric Company. Inc., of South Bend. This system features new, standardized metal-clad switchgear . . . replaces dangerous, inadequate equipment inside and outside the factory.

Two 3000-kva transformers, equipped with load ratio control, feed metal-clad switchgear through flexible interlocked armor cable. The compact, safe, metal-clad lineup, rated at 4.16-kv, in turn feeds five 1000-kva load centers in a reliable radial distribution system. High-voltage fluorescent lighting considerably reduces equipment costs. Neutral grounding increases system reliability and economy.

Kaiser-Frazer, with pre-assembled G-E equipment, has saved months of time, cut installation and maintenance costs, provided greater safety, and made the best possible use of plant space.

For information to help in your modernization plans, contact your local G-E sales representative—or write direct to General Electric Company, Schenectady 5, N. Y.



TWO TRANSFORMERS, 3000-kva, 27-4.16-kv with load ratio control, are installed by contractor.

*Reg. Trademark of General Electric Company.







Variable Speed Drive

(20)

A new electronic variable speed drive for fractional hp motors. This packaged drive consists of an electronic, adjustable speed control unit driving a series motor. It provides a wide, stepless range of speed control with good speed regulation under varying loads. With the optional dual range feature, speeds from 100 to 3500 rpm are available. The motor can be started, stopped or dynamically braked and can be accelerated to preset speeds. It uses a series motor, which makes use of both ac and de current output from a single thyratron tube. As a pilot device, the pushpull selector switch is used.

Arrow-Hart & Hegeman Electric Company, 103 Hawthorn St., Hartford 6, Conn.



Capacitor

(21)

A new 7.5 kvar capacitor for secondary network system voltages. Unit is specifically designed for application to network systems rated 208 and 216 volts. It is built for operation in ambient temperatures as high as 55 C (131 F). Small in size, unit can be installed on a vault wall above transformers and other equipment, or on ceiling or floor. Hangers for six units, designed for placement of capacitors above transformers on a vault wall or on cover of transformer, are also available. Hangers are arranged for use of fuses. Capacitor is in a standard ID case and has a protective outdoor paint finish.

General Electric Co., Schenectady 5, N. Y.





TOLEDO

THREADERS AND POWER DRIVES

Gear Up jon!

Sure enough—the street scene at right is really Broadway, N.Y.—where the mechanic is operating a Toledo Power Drive and No. 2 Geared Threader. This job of installing new 3" red brass for water service from the city main was handled by Water and Sewer Service Co.

Time was important on this job—as a trench was dug in the street and traffic had to detour.

Time was saved by high-speed performance of the Toledo Power Drive operating Toledo geared tools! This also means labor-saved . . . and money saved for the contractor!

Wherever the job—in shop, plant or in the field—you can speed up pipe fitting and reduce costs with Toledo Tools! Precision-built . . . dependable. Order through your supply house. Write for catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.



Toledo Power Drive operating a Toledo No. 2 Geared Threader on 3" red brass for water service at 217 Broadway, New York City.



No. 2 geared adjustable threader, 2 1/4" to 4" pipe, incl. *Lighter weight* than any other tool of this capacity!

No. 2BR Geared A d j u s t a b l e, Threader, 2 ½" to 4" pipe, incl. New type 3-jaw pipe holder.



RELY ON THE 50 YEAR LEADER



DO

.. POWER PIPE MACHINES



TV Line Splitters

(22)

A new group of TV accessories for dividing any TV transmission line into four branch lines. Called line splitters, they are available in the following models: LS4-1 divided one 75 ohm line into four 74 ohm lines: LS4-2 divided one 300 ohm line into four 75 ohm lines; LS4-3 divides one 75 ohm line into four 300 ohm lines; and LS4-4 divides one 300 ohm line into four 300 ohm lines. Line splitters were designed to provide branch lines to distribution amplifiers in master TV systems. Requiring no power, they can be installed at remote locations. May also be used to provide reception for two to four TV sets, from one antenna. Interaction between TV sets, when present. can be eliminated by inserting attenuation pads between line splitter and each TV

Blonder-Tongue Laboratories, Inc., 526 North Ave., East, Westfield, N. J.

Transformer

(23)

A 800-ampere unit has been added to the line of JKP-O indoor-outdoor butylmolded transformers. Type JKP-O current transformer line is now available in ratings of 200:5, 400:5, 600:5, 800:5. Ratings are obtained by passing the line conductor once through the window of transformer; looping primary conductor two or more times through window provides additional ratings. New 800-ampere transformer has a 150% continuous rating. Transformers are applicable to both single-phase and three-phase circuits, and installations can be made outdoors on poles and walls and indoors in boxes and on walls.

General Electric Company, Schenectady

Water Heater

(24)

Three new tabletop model water heaters designed with top connections. The cold water inlet, hot water outlet, and electrical connection box of table-top models have been located at the top of the tank so that connections will be at the top of the water heater to reduce installation time and cost. Each water heater has an external control on the front of cabinet for adjusting water tem-

perature. Control can be turned to "hot" for high-demand washday needs, "Normal" for day-to-day use, or "warm" for limited operation. New line consists of a 30-gallon tank with single heating element, a 40 gallon tank with single heating element, and a 40-gallon tank with twin heating elements and interconnected thermostats for limited demand operation. Also available in water heater line are round models with capacities of 30-, 40-, 52-, 66- and 82-gallons. Each incorporates same features of table-top models with exception of top connections, and each has single or twin heating elements. General Electric Company, 310 W. Liberty St., Louisville 2, Ky.



Rivets (25

Fastenings to cinder block, brick and cement as well as wood, metal laminated over insulation, and most masonry materials are made with a new hammer-driven blind rivet. Southeo drive rivets are inserted in a ¼-inch diameter hole and expanded from one side with a hammer. They are said to save time and labor in attaching BX cable, pipe, conduit and fixtures to wall material.

Southco Division, South Chester Corporation, Lester, Pa.

Plug-In Alarm System (26)

Panalarm "50", a new type of plug-in annunciator system incorporating complete interchangeability of circuits and functions. A single, standard unit can be used to signal any "off-normal" condition throughout a plant. Plug-in units are hermetically sealed, and suitable for all Class 1, Division 2 locations. Used either as running or trouble signals, the systems provide both an audible and a visual alert signal. Visual signals are provided by either torpedo bullseye lamps or backlighted, illuminated nameplates. "50" is a complete, pre-wired, multiple unit system designed to include all basic signal circuits. Changes of circuits, operating sequences or forms are made by connections on an enclosed terminal block mounted on rear of cabinet.

Panalarm Products, Inc., 6312 North Broadway, Chicago 40, Ill.



"Dongan" CONTROL TRANSFORMERS

USED with remote control equipment, including all types of magnetic switches, recording devices, relays, solenoids, thermostat controlled devices, small motors, variable speed devices, control valves for fluids, gases—and for all other purposes where lower than available line voltage is required.

Other Types of "Dongan" Transformers

Machine Tool, Power Circuit, Signaling, Oil and Gas Ignition Transformers.

Write for New Catalog

PROMPT SHIPMENT

DONGAN ELECTRIC MFG. CO.
2980 Franklin St. Detroit 7, Mich.

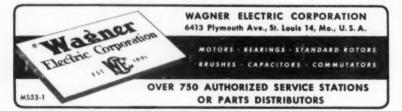
The Dongan Line Since Nineteen-Nine





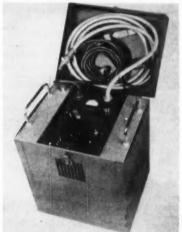
- Commutator is insulated from the short-circuiting ring with a mica washer.
- 2. The short-circuiting ring is made of brass.
- Short-circuiting ring is insulated from the commutator hub by a bakelite washer that eliminates harmful shaft currents.
- 4. Wagner commutators have a reinforcing steel shell.
- The entire assembly is molded in high impact phenolic molding compound.

Do you have Wagner's Catalog MU-40 and Fast-Moving Parts Bulletin MU-122? If not, write for your copies today. Every repair shop can use these helps.



Five new electrical tapes, all with heatcuring masses, have been added to the Permacel electrical tapes line. are available in several kinds of backing and include: P243 white acetate cloth, designed for use where a non-corrosive backing, with a high hold and very heatstable adhesive, is necessary. acetate fiber is a laminated product of .00088-in, cellulose acetate film, laminated to a .004-in. rope paper. It is recommended specially for winding heavyduty coils, and for general purpose applications in armature windings. P252 orange-yellow polyester "Mylar" film uses the newly developed polyester film as backing, offering maximum electric protection with very high insulation resistance. It is recommended particularly for insulation under and over lead wires in coils and transformers where regular acetate film tape has insufficient tear resistance. It is for fine wire constructions: Class B insulation, Festerite or Permafil treated coils, small motor slot insulation. P271 yellow flatback paper has a heatcuring (Thermosetting) adhesive. It is used in similar applications to those recommended for P27, except that P271 can withstand high temperatures.

Industrial Tape Corp., New Bruns-wick, N. J.



Instrument

(28)

The Johnson Cable faultfinder and de proof test unit is an impulse or surge generator operating on a well established principle which tests various types of cables, locating faults, and prooftests to locate incipient faults. A loud, cracking noise like a pistol shot is produced at the location of the fault. The "Shot" is repeated at approximately 1 to 3 second intervals. With the impulse applied to the cable, which has been disconnected from the system, the operator follows the route of the cable until he can locate the exact spot where the noise is heard.

Electrical Distributors Company, Liberty Trust Bldg., Philadelphia 7, Pa.

Specify-

COLUMBIA ELECTRICAL PRODUCTS



A. B. C. ARMORED CABLE

FLEXIBLE STEEL CONDUIT



All COLUMBIA electrical products are Approved by Underwriters' Laboratories Serving the Electrical Industry Since 1912



Columbia Cable & Electric Corporation

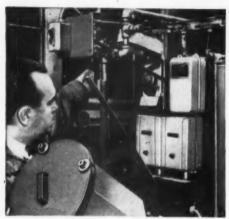
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Save Time, Manhours, Power Costs, With G-E Time Switch Applications



EASY TO READ AND ADJUST



POWERED BY A TELECHRON® MOTOR



A G-E TIME SWITCH FOR EVERY ON-OFF JOB

Uses for time switches range throughout on-off jobs in farm, shop, home

When you buy a General Electric time switch, you get a product which will give you more dependable, more accumente service. G.E. has a complete line of time switches—one for every on-off operation.

HERE'S HOW YOU SAVE:

- Reduce manpower needs
- Cut power consumption
 Reduce waste, spoilage
- Get greater efficiency

MACHINERY CONTROL

On-off control of pumps, compressors, water softeners, mixers, tumblers, and die cutting equipment, etc., can be done easily and efficiently with a G-E time switch.

LIGHTING CONTROL

Time switch control of parking lot and apartment house lights, store and shop-window lights, signs and spectaculars, plant and farm floodlights, means more economical, efficient utilization of equipment and power.

CONTROLLING AIR-CONDITIONING UNITS

Using time switches means that the unit is off when not in use, and on prior to the time when the building will be occupied. Automatic control means savings in wear and tear on the unit, and in lowered cost for operating power.

PRE-HEAT CONTROL

Make possible heating ovens before the work day begins save manhours lost in waiting for units to reach required temperatures.

ORDER TODAY

Contact your authorized G-E Agent or Distributor, or write for Bulletins GEC-535 and GEC-578, Section 603-146, General Electric Company, Schenectady 5, New York.



Cable Clamps

(29)

A non-inflammable plastic cable clamp, made of Saran, a strong thermo-plastic material. Other characteristics are its inertness to fungicidal attack, ability to withstand changes in atmospheric conditions and resistance to corrosion or sweating. Saran is not affected by prolonged immersion in water and remains stable when exposed to mild acids, chemicals, oil, etc. Because Saran is a pliable material, clamp can be opened to any dimension for easy sliding over wires, cable, pipe or tubing. Edges are rounded to prevent damage to insulation. Available in 17 stock sizes, ranging from 4-in. to 11-in.

Holub Industries, Inc., Sycamore, Ill.



Reel

(30)

Heavy duty reels designed for handling drop wire, large bulky coils of cable, etc. They are for all around use and adjustable for all coil sizes. Available in 25-inch and 30-inch sizes. Adjustment for coil eye is 6½-in. to 18½-in., and coil width is 7½ inches.

HyKon Manufacturing Co., Alliance, Ohio

Telephone

(31)

A new "all-in-one" telephone, a combination wall-desk instrument designed to fit any application with a minimum of modifications. The phone is a universal local-battery telephone which can be converted to a manual common-battery phone without adding either electrical or mechanical parts. It can be converted to a common-battery dial phone by the addition of a dial and dial bracket. It can be used on either wall or desk without alterations. The handsets, equipped with





ELECTRIC

Koiled Cords, are molded of a special thermoplastic material. It features a new hook-switch consisting of two sensitive enclosed switches, sealed from dust and dirt. All parts of the phone may be removed or interchanged with a screw-driver.

Connecticut Telephone Corp., Meriden, Conn.



Signal Lights

(32)

Three new models of Gyralites specifically designed for general industrial use. These lights project a high intensity colored or clear beam which rotates with a wide, sweeping action. Type 1740 has a single PAR-46 sealed beam lamp mounted in gyrating mechanism within a cast aluminum alloy housing. Type 17340 has two type PAR-46 sealed beam lamps, one mounted in gyrating mechanism, the other in the body as a stationary clear light for use as a headlight or back-up light on moving equipment. Type 15100 has stationary lamp and rotating reflector for low voltage duty. Some of the applications for these lights are on overhead cranes, transfer cars, at hazardous doorways, crosswalks, open pits and manholes. Also for call signals in large field operations when distance is beyond range of sound signals.

Pyle-National Co., 1334 North Kostner Ave., Chicago 51, Ill.



Conduit

(33)

Soapstone non-metallic conduit for concrete-encased underground power and communication circuits is now available in the flat-sided design. Flat sides permit multiway duct systems to be built quickly without the use of spacers. The new conduit has the same characteristics as Soapstone round conduit.

Soapstone Duct Company, 110 Linfield Drive, Menlo Park, Calif.



HYDRAULIC Knock-out Punch Driver is 60% faster!

Drive knock-out punches with an amazingly low-cost "Porto-Power" hydraulic jack! A few easy strokes on the pump does it! Compare that with the old-fashioned method of a half-hundred knuckle-busting turns on a wrench. With "Porto-Power," you save on every hole punched — workmen are happier, safer — dies last 6 times longer — speed is spectacular! Pays for itself on the first good job!



A LOW-COST KIT FOR EVERY RANGE -

Blackhawk Knock-Out Punches and the hydraulic rams are available in complete kits serving \(^{1}\)2" up to 2" and \(^{1}\)2" up to 4\(^{1}\)2" openings. Attention, owners of wrench-operated punches: You can buy hydraulic equipment separately.

nd big extra uses for hydraulic

Blackhawk electrician's equip-ment features famous "Porto-Power" hydraulic units. Unlike ordinary jack units, pump and ram are separated by a flexible hose. Ram is all-directional



unching, pipe bending and allied jobs. Low-cost Blackhawk Benders ... today's No. 1 line — handle both rigid and thin-wall conduit better, faster.



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for two helpful bulle-tins, 50-B and P-50, Buy from leading supply houses.

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	Dept. P-2013, Milwaukee 1, Wis. Please send me immediately your free Catalogs 50B and P-50 covering the full line of Black- hawk Electrician's Equipment.
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Product Briefs

- (34) Dee Electric Co., Chicago, Ill., has announced a new solder pot that will accommodate heavy units for soldering, such as motor commutators. Unit is available in several sizes. . . (35) Industrial Devices, Inc., Edgewater, N. J., has developed new insulated test clips, designated as Model No. 1410A. They are available in various colors for identification test equipment leads.
- (36) The Syntron Company, Homer City, Pa., has brought out a new 2-inch capacity, heavy-duty electric hammer drill . . . (37) Chase-Shawmut Co., Newburyport, Mass., now imprints its cartridge-type fuses . . . (38) Photoswitch Incorporated, Cambridge, Mass., has announced a new photoelectric counter set PIC.
- (39) A new industrial crepe paper has been developed by General Electric Company, Pittsfield, Mass. . . . (40) The new Prepo "Master" torch kit offers users a heavy duty professional torch with six interchangeable burners and tips. Manufactured by Appleton Electric Company, Chicago, Ill. . . . (41) Kepco Laboratories, Flushing, N. Y., has developed No. 700 series voltage regulated power supplies.
- (42) Combustion Control Corporation, Boston, Mass., has announced the "Firetron," a photo-conductive cell responsive to infrared of any flame regardless of type fuel used. . . (43) Abbeon Supply Co., Jamaica, N. Y., has introduced a new rid-all double bulb electronic deodorizer. . . (44) Ford Division of Ford Motor Company, Dearborn, Mich., has announced that its new 1953 line of F-100 series trucks including the pick-up and panel delivery will be equipped with fully automatic transmissions as optional equipment.
- (45) A new hydraulic end-loader for all makes of motor trucks has been announced by the Galion Allsteel Body Company, Galion, Ohio. . . . (46) The Lug-All Co., 331 E. Lancaster Ave., Wynnewood, Pa., has broadened its line of combination winch-hoists to include three new models.
- (47) Eagle Electric Mfg. Co., Inc., Long Island City, N. Y., has completely redesigned its line of wall plates. . . . (48) A new line of mine power tools has been introduced by Cummins-Chicago Corp., Chicago, Ill. . . . (49) The Porter-Cable Machine Company of Syracuse, N. Y., has developed a new set of equipment consisting of a high-speed, kick-proof electric saw and three types of abrasive blades, to simplify cutting many tough building and industrial materials.



The DUTCH BRAND Insulating Foursome

DUTCH BRAND Friction Tape

DUTCH BRAND Friction Tape is well known for its dependability. It does not fray... has the necessary strength for good workmanship... the correct adhesion makes firmly held joints... removes from the roll easily and it has long life on the job. 2000 volts for single thickness. It is the type tape that is dependable and easy to work with. Be sure to get this top quality by asking for DUTCH BRAND.

2 DUTCH BRAND Plastic Tape

DUTCH BRAND Plastic Tape has proved a favorite because of its excellent performance. By actual test and use it has excelled in the plastic tape field. It is super thin, with ample strength and 150% stretch. It resists weather, oils, acids and corrosive chemicals. It is available in regular .007" thickness or heavy duty .010" thickness for winding heavy cables, heavy electrical harness or for use with power driven tape machines. Dielectric resistance averages 1000 volts per mil of thickness. The best test is to try DUTCH BRAND Plastic Tape...order it from your supplier today.

DUTCH BRAND Rubber Insulating Tape

Here is an old dependable of the electrical trade. "Tops" for years in electrical insulating work. It fuses instantly without heat and has the strength and stretch necessary for good joints. It resists up to 18,000 volts through a single thickness. It contains no corrosive chemicals. Its long life makes it dependable and workmen find it easy to work with. It costs no more to have the best ... just specify DUTCH BRAND on every order.

"DB" Wire Connectors

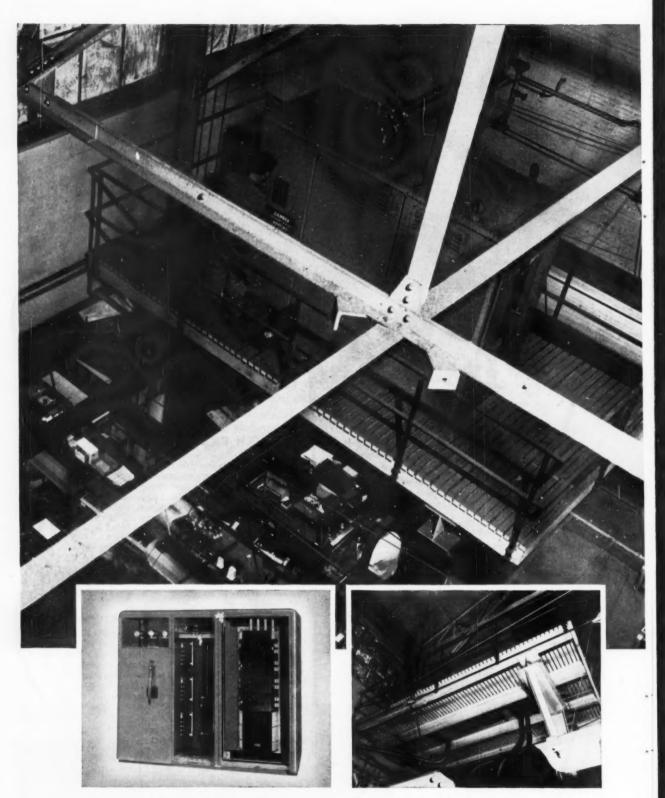
"DB" Wire Connectors are the latest addition to the DUTCH BRAND line. They are made to careful specifications and high standards as has characterized DUTCH BRAND products for over forty years. They are made of high grade pheolic material and designed with long skirt for full insulating protection. They are weatherproof . . . vibration proof . . . resist pull-out-and are available in four standard sizes. Knurled design makes them easy to use. Order from your supplier along with your tape requirements.

ALL "4" Available At Your Electrical Wholesalers



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BUILT-IN PROTECTION Separately mounted protective devices are eliminated. Factory-assembled Westinghouse Power Centers offer complete substation protection.

EASY TO INSTALL Floor view of completely enclosed unit. Westinghouse Dry-Type Power Centers are safe . . . to hook up, simply connect high and low-voltage leads.



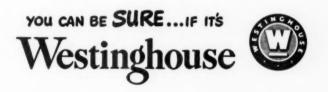
How Westinghouse Power Centers release space for production

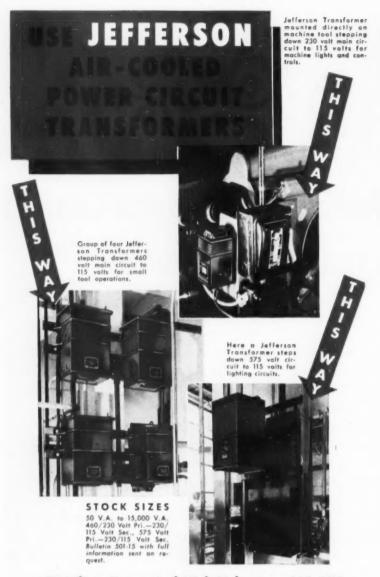
Confronted with the need to modernize his electrical distribution system, an eastern radio and electronics manufacturer installed four Westinghouse Dry-Type Power Centers on overhead platforms, releasing much needed floor space for production.

Change-over from the old system was accomplished section by section, without interrupting production. Each 300-kva integral Power Center, completely assembled, was spotted overhead, close to the center of the load it would serve. Secondary runs were thus shortened, resulting in lower line losses, better regulation, and increased productive capacity of the machinery.

As the old conventional equipment in floor-level vaults was dismantled, additional productive equipment was moved in. The entire change-over was accomplished in 60 days.

Westinghouse Dry-Type Power Centers can bring savings like this to your plant, too. With all protective equipment factory co-ordinated and assembled as a unit, they can be installed quickly and easily. Air cooled, they are safe and eliminate most maintenance headaches. For further information, contact your Westinghouse representative, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, Pennsylvania.





Distribute Economical High Voltage ... 460-575 Provide Low Voltage Only Where Needed ... II5-230

High voltage power distribution provides greater volt-ampere capacity with no increase in copper wire and steel conduit sizes. You save materials, wiring costs, maintenance costs, installation time and eliminate duplicate wiring.

Jefferson Power Circuit Transformers can be mounted directly on or adjacent to machinery or wherever low voltage is required. Air-Cooled "Dry Type" construction makes Jefferson Transformers exceptionally compact and easy to install. Ample wiring compartments and both ½" and ¾" knockouts are provided for rigid or flexible conduit connections.

Approved by Underwriters' Laboratories, Inc.

JEFFERSON ELECTRIC COMPANY

Bellwood, Illinois



CATALOGS and BULLETINS

- (50) Industrial Pumps are illustrated and described in 96-page catalog, including sectional views, selection tables and technical data on such types as centrifugal, side suction, motor mount, portable, self-priming centrifugal, high pressure and vertical and split case centrifugal. The Deming Co.
- (51) DISRUPTER SWITCHES for 600volt ac or dc service, combining the functions of disconnect and load interrupter, are illustrated and described with operating and application data in bulletin 5208. Delta-Star Electric Div., H. K. Porter Co., Inc.
- (52) Motors, totally-enclosed and explosion-proof for safe operation in dangerous, damp and dusty locations, are illustrated and described in color in 8-page bulletin, including construction, application and operating specifications. U. S. Electrical Motors Inc.
- (53) INCANDESCENT REFLECTORS for industrial lighting applications are illustrated and described in 16-page catalog, including RLM standard dome, shallow dome, and high bay units, mercury vapor units and glassteel units for interior and exterior use. Leader Electric Co.
- (54) CARBON PRODUCTS, including brushes of carbon graphite, electrographitic graphite, metal graphite and silver graphite; carbon and metal graphite plates; and silver alloy contacts and brushes; are illustrated and described in 20-page catalog. Superior Carbon Products Inc.
- (55) SILICONE INSULATION (Class H) is the subject of an 8-page booklet on the performance of Class H insulated equipment and on the results of many applications of this insulation with a life expectancy of 10 to 100 times that of the next best class of electrical insulation. Dow Corning Corp.
- (56) ELECTRICAL INSULATING cotton, glass, and asbestos woven tapes, braided sleevings and cords are illustrated and described with practical data on applications and methods of applying and specifications, in 28-page catalog. Insulation Manufacturers Corp.

- (57) Pumps, self-priming type, ranging in capacity from 2-inch to 10-inch pumping 240,000 gpm, are illustrated and described in folders, including performance tables, selection and engineering data. Gorman-Rupp Co.
- (58) Controllers, time-cycle type for timing industrial processes and operations, are illustrated and described in operating detail in bulletin No. C305. The Bristol Company.
- (59) LIGHTING FIXTURE, industrial slimline unit with over 90% efficiency, 20% uplighting and 30 degrees shielding, is illustrated and described in folder. Smithcraft Lighting Div.
- (60) LIGHTING FIXTURES, over thirty different types of fluorescent and incandescent units, are illustrated and described in 4-page reprint from Sweet's Architectural File, including troffers, surface and cornice units, recessed boxes, interior and exterior lanterns, hospital and public building fixtures and exit and directional units. Gruber Lighting.
- (61) RESIDENTIAL LIGHTING is the subject of 36-page booklet "Planned Lighting For Better Living", illustrating and describing incandescent and fluorescent units. Globe Lighting Products Inc.
- (62) POWER FUSES, a series of outdoor, dropout, double vented types, 7.5 kv through 69 kv, 50-100-200 amps, are illustrated and described with sketches, specifications, application and operating data. Southern States Equipment Corp.
- (63) FLEXIBLE CORDS are illustrated and described in 24-page catalog, covering complete data and applications for Dynaprene and rubber jacketed cords and braid covered types, with wire and cable selection information. Whitney-Blake Co.
- (64) AIR COMPRESSORS, oil-free, 25 to 300 hp, 172 to 8800 cfm, 30 to 150 psi, are illustrated and described in 4-page folder, with specifications, operating and application data. Joy Mfg. Co.
- (65) Motor Shop equipment catalog contains 64-pages of illustrated data on equipment, tools, accessories, parts and material for electric motor repair shops, including testing equipment, motor renewal parts, insulations, and controller components. Brownell Distributors, Inc.
- (66) ELECTRIC HEATERS, blower type portable units, blower type floor-wall-ceiling mounted units, forced air units, radiant and convection heaters and



PIPE WRENCHES

Guarantee you against wrench housing trouble and expense

Look for the wrench with that guarantee label to make sure you get the extra-easy work and extra durability that have made RIDID the world's most popular wrench.

Only PID assures you a hookjaw that always rides freely in the housing; adjusting nut always spins easily to pipe size. Replaceable alloy jaws won't slip or lock on pipe. Handy pipe scale on hookjaw. Safe stout comfort-grip I-beam handle.

Save work and money—buy genuine RIMIDs at your Supply House.

THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U.S.A.







Fouled contacts cause costly burnouts and down-time. Use VAP-OIL-TITE FITTINGS with Plastic Covered Flexible Metallic Conduit for Sure Sealing of wiring on oil, water, dust and vapor tite equipment.

VAP-OIL-TITE'S exclusive threaded bushing not only insures positive grounding but also makes fitting easier to install because a collar covers metal edges making burring unnecessary. Furnished in numerous types with body sizes from 3/8" to 2". Write or wire today for bulletin #MT-104 giving types, sizes and prices.

SIMPLET ELECTRIC COMPANY
- 3600 Potoma: Ave. Chicago 51, Illinois
- 31 Park Place - New York 7, New York

thermostats and contactors, are illustrated and described in 8-page catalog D-52, with application charts and data. Edwin L. Wiegand Co.

- (67) Installation Manual for all types of master TV systems contains technical data on the operation of the various units, diagrams on installation, and data on laying out TV system. Blonder-Tongue Laboratories, Inc.
- (68) Service Stations lighting is the subject of 32-page brochure illustrating and describing fluorescent, spot and flood lighting for pump islands and other areas of a station, with data on accessory equipment. Guardian Light Co.
- (69) HOOK-ON-INSTRUMENTS are illustrated and described in 8-page booklet GEC-901, including applications, operation and basic features on hookon volt-ammeters, wattmeters and power factor meters. General Electric Company.
- (70) METAL FRAMING catalog contains specifications and engineering data on metal framing systems for supporting equipment, including fittings, parts and accessories, pipe hangers, pipe-cable and beam clamps. Unistrut Products Company.
- (71) LIGHTING FIXTURES, surface mounted types for low ceilings, for 2 or 4 fluorescent lamps, louvered bottoms, translucent side panels, are illustrated and described in 4-page bulletin, with construction and installation features. Westinghouse Lighting Div.
- (72) Tool Catalog contains 24-pages of illustrated data on all the tools, including 82 models of regular and custom-built pliers and a line of adjustable with accurate diagramming of tools and pertinent technical data. Utica Drop Forge & Tool Corp.
- (73) STADIUM LIGHTING is the subject of 8-page bulletin describing in illustrated detail the floodlighting of a typical outdoor athletic arena with floodlights sealed against moisture and dirt. The Pyle-National Co.
- (74) Wiring Guide No. 19 contains 120 pages of information on the full line of surface metal raceways and fittings for electric light and power and telephone. The Wiremold Co.
- (75) Drive Rivers which provide nailing of metal sheets, fixtures, plates, clamps and straps to cinder block, metal, concrete and plaster by the blow of a hammer, are illustrated and described in 4-page bulletin. Southco Div., South Chester Corp.

Industry is Lighting UP Wheeler DAY-FLO UPLITER

28%

Combining UP and DOWN lighting for Maximum Efficiency

Today's outstanding new lighting fixture — rapidly being adopted by every branch of industry!

Center V channel, deep shielding side reflectors and continuous openings above the lamps provide maximum effective light while reducing direct glare to a minimum!

Designed to sell on SIGHT
its 28% UPWARD and 72%
DOWNWARD light distribution
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lighting and seeing comfort!

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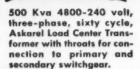
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Reader's Quiz

Locating Grounds

QUESTION DRAW We have a 1000 kva transformer bank, voltage 2400 to 440 volts. It is hooked delta-delta. We sometimes have trouble to locate grounds on this bank, so we would like to ground a point on the secondary winding to simplify things. Can someone tell me the best method to do this—one that will conform to the Code? What is the highest permissible voltage to ground on secondary circuits?—M.D.

ANSWER TO D22-For an indication of ground developing on 3 phase 440 volt delta connected circuits, use voltmeters. Standard 440 volt full scale meters would be used in this instance. Wye connect the meters, with one wire from each meter connected to a different phase leg, and the other meter legs tied together and grounded. The normal voltage should be in the vicinity of 270 volts. If a ground develops on any phase of 440 volt system the voltmeter connected to that phase will show a reduced voltage depending on the severity of the ground. A zero ground, of course, resulting in a zero voltmeter reading on that phase of the voltage on the other meters will increase at the same time, becoming maximum or 440 volt at zero ground.-W.E.G.

ANSWER TO D22-The most practical way of locating grounds is to use indicating lights from each phase to ground. This can be accomplished by using two 220 volt bulbs in series from each phase to ground. A better system would be to use three small 440 to 110 volt transformers connected in closed Y with star point grounded on primary and secondary. Use two 110 volt bulbs in parallel across each transformer secondary, so that if one bulb fails, it can be replaced. If both bulbs are out, then a ground has occurred on that phase. Highest permissible voltage to ground depends entirely on the voltage that is being used. In commercial wiring, it is limited to 220 volts to ground. In mining and substations, the voltage to ground may be as high as 4160 volts to ground.-E.S.H.

Compensating for Motor-Start Reactance

OUESTION E22-We have a 750 kva 4160 volt generator, 3 phase 60 cycle, 514 rpm, 4 wire (4160/2400V) driven by a diesel engine. The exciter is belt driven and the voltage regulator is of the usual resistance type, Silverstat. We desire to operate two 200 hp motors, a small amount of lights, and small motors of approximately 75 hp. The large motors are to operate air conditioning compressors and as such are subject to automatic starting. Reduced voltage starters have been considered but the instantaneous voltage dip of the generator before the voltage regulator can restore voltage will cause severe light flicker and possibly drop out the undervoltage devices on control equipment. We have heard of series capacitors being used to automatically compensate for the starting reactance of the motors and at the same time use full voltage starters for the controllers. Can someone tell us how to figure the rating of the capacitors needed, and any experience with such applications? Normal utilization voltage is 240 through a stepdown transformer, however if desirable, the motors may be run directly off the 4160 volt generators. It is understood that the compressors can be unloaded during the starting period and that only one of the 200 hp motors will be required to start at a time. but that after one has started the other may start .- L.R.B.

ANSWER TO E22-The 4160 volt motor will help if the voltage dip shows up between the primary of the transformer and the 200 hp motor. It will allow you to use a smaller size transformer. Your electrical repairmen will enjoy the 240 volt motor more than the 4160 volt motor for safety reasons. The best voltage regulator depends on how soon the diesel engine will pick up the load and how soon you will get a high enough excitation voltage to carry the load. You can use a 5 or 10 hp motor to bring up to full speed the 200 hp motor in order that five times the running current of the 200 hp motor should not show up until the load is thrown on the 200 hp motor. At 240 volts the normal full load current is about 470 amps. The no load current should be about 200 amps at the time when the 200 hp motor will be thrown on the line instead of the 2350 amps that the 200 hp motor will draw under normal starting conditions. When the load is applied the current may go up from the 200 amps to about 800 amps for an instant and then come to rest at 470 amps—H.S.

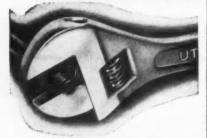
EDITOR'S NOTE—Any discussion of series capacitors to compensate for motor starting reactance would be complex beyond the scope of this section. Complete information on this application of capacitors is available in "Capacitors for Industry", a book by W. C. Bloomquist, published by John Wiley & Sons, Inc., New York, N. Y.

Testing Current and Voltage of Motors

OUESTION F22-I'd like to know hore to test the secondary current and voltage of a wound rotor induction motor. In this case the drum controller, (or dial type controller), and resistor bank are used for both starting, and speed regulating of the motor. With the motor running I tried using a G. E. type AK-1 hook-on voltammeter on the leads from the slip rings on the motor to the controller but got no readings on either the voltmeter or ammeter. Can someone tell me why there were no readings? Also how can I test the voltage or amperage through various speed selections of the drum controller?-A.R.

ANSWER TO F22—Several years ago I ran tests on a series of wound rotor induction motors and at first ran into some of the same troubles you mentioned. The ammeter used should be an electrodynamometer or moving coil type. This is the common everyday sort of ammeter which reads either ac or dc on the same meter movement. The reason for choosing this type meter is that the voltage induced in the rotor circuit by the stator circuit varies in frequency with

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motor speed. For example, with an 1800 rpm 60 cycle machine, the induced voltage would be 60 cycles at standstill. However at full load speed (about 1750 rpm) the rotor current frequency will have dropped to about 2 cycles per second. This will explain why you got no ammeter readings with the G.E. type AK-1 hook on ammeter. This meter is an AC instrument designed for 60 cycles. The rotor current being of very low frequency acts almost like dc and gives no response on your meter. I used the switch as a meter protective device to shunt out the high starting current. After the motor is up to speed the switch is opened to obtain the current readings. The voltmeter is the same ac-dc type as the ammeter and will need to have a low scale for most motors. With this setup you can read the rotor voltage and current for any setting of the motor controller—C.H.CM.

ANSWER TO F22-With the motor running at full speed the frequency of the current in the rotor leads is very low. About 2 cycles per second. At exactly synchronous speed the frequency would be zero but since the motor has some slip the frequency would be a few cycles. At half speed it would be 30 cycles per second. The only type of meter which would give an accurate reading regardless of frequency would be the dynamometer type. The induction type would be the least accurate. At start the frequency is 60 cycles for the rotor current which should give a reading on the usual 60 cycle meter. Since at start the rotor resistance is usually in the circuit it will reduce the rotor current. It will also be reduced by the higher 60 cycle impedance of rotor. Try a smaller current meter to get a reading. When the resistance is all cut out (short circuited) the voltage across rotor is very low but the current probably higher. Try a lower reading voltmeter. Use only meters which will give fairly accurate readings regardless of frequency.-E.B.

Insulating Oil

QUESTION G22—Why is insulating oil used in the top of a high voltage bushing?—E.S.H.

ANSWER TO G22—Insulating oil is not only used in the top of a high voltage bushing but carried throughout the internal structure of the bushing. The internal structure of the bushing is composed of impregnated paper insulation, insulating Micarta and tin foil or a composition material which

has a tendency to be porous. During temperature changes the porous materials expand and contract causing air bubbles to enter the bushing. These air bubbles weaken the bushing to a point where breakdown or flashover may result, hence the use of the oil. Corona effect may also result without the oil in certain instances due to air bubbles which are ionized.—I.B.K.

ANSWER TO G22-As a bushing represents a vital portion of all electrical equipment insulation, overall flashover must always be considered in establishing insulation revels. Generally it will be found that the volt-time characteristics of bushings on a transformer differ from the same characteristics of the internal transformer insulation. With long time lags, bushing flashover is slightly less than the windings breakdown. Impulse strength of transformer windings is practically identical for negative or positive waves while the critical flashover of the bushing may be higher for one polarity over the other. In an effort to minimize breakdown and increased power factor of the bushing and to provide insulation values greater than the transformer windings, oil is used in high voltage transformer bushings, or in bushings connected to other electrical equipment operating at high voltage.-L.W.F.

Testing Switches

QUESTION H22—How can I test switches that overheat on their rated load before I install them?—H.S.

ANSWER TO H22-Measure the contact resistance of a switch that does not overheat. Using this as a standard measure the contact resistance of the ones to be installed. If the resistance exceeds the standard value it will overheat. A Thomson double bridge can be used. If none is available a low reading voltmeter (usually milli voltmeter), an ammeter, rheostat and storage battery can be used. Rated current is fed through switch contacts and milli volt drop across contacts taken. If the milli volt drop exceeds the drop for the good switch it will overheat. Use caution in using the milli voltmeter as it can be easily damaged by excess voltage.—E.B.

ANSWER TO H22—Since heating in a switch is due to high contact resistance, a simple method for checking the switches before installation would be to place a full load in amperes on the switch and then measure the voltage drop between terminals. A little experimenting may be necessary in order to establish a dividing line be-

tween the good and the bad switches. I would expect copper contact switch to show a voltage drop of 10 to 15 milli volts under full load .-- R.E.

TO H22-If these switches are of fairly high current rating probably the best way would be to use a transformer similar to welding transformers. These transformers have high secondary currents but the voltage is low and so little power is involved in the tests. A tapped transformer or grid type resistor would give a rough central of the current. A current transformer permitting several ratios and an ammeter would complete the needed test equipment.-P.S.

Can you ANSWER these **QUESTIONS?**

QUESTION \$22-We have a number of adding and other office-type machines that contain universal ac-dc brush motors. We have noticed that brush life is shortened when these motors are operated on alternating current when compared to usage on direct current. The machines compared are identical as to make, model, physical condition and overall daily usage and voltage was within 5 percent of manufacturer's nameplate reading. Can anyone explain why brushes wear faster on ac than dc.-L.W.F.

QUESTION T22-We have two of the old style wall type telephones with a crank on the side that turns a magneto generating ac current for ringing, and two dry cells for dc talking.

I would like to know if we could use a 115 volt power line for the line wires having a phone at each end (about 2000 feet).

Could resistors be used in each line wire at each phone to hold out the ac

voltage and still connect the phone and battery in series to the line for

talking?-E.E.M.

QUESTION U22-Wound rotor induction motors have brass slip rings while synchronous motors have cast iron slip rings. Can someone tell me why different metals are used for each type of motor?-M.D.

QUESTION V22-I recently noticed a wiring diagram showing the use of capacitors to brake a three phase These capacitors were connected across the phase leads when the power to the motor was interrupted. How is the braking action obtained?

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PLUGS and RECEPTACLES . FLOODLIGHTS . EXPLOSION PROOF FITTINGS . MULTI-VENT AIR DISTRIBUTION

Questions on the Code

Answered by

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.

GLENN ROWELL, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

B. Z. SEGALL, Consulting Electrical Engineer, New Orleans, La.

F. N. M. SQUIRES, New York Board of Fire Underwriters, New York, N. Y.

Pathway Fixtures

Q. Would the Code accept fixing pathway fixtures to trees approximately 3 ft. above the ground on 1-inch conduit using condulet splice box at ground level and feed with 14/2 Neoprene cable?—G.M.D.

Assuming that the fixture and the box are approved for exposure to the weather and that the conditions involved with the installation do not promote mechanical injury. this part of the installation appears to be all right. The question of support on the tree could be questionable depending upon the size of the tree and the possible mechanical abuse which could result from the inclination of most children to climb trees or from other causes. The fixture and the conduit must be grounded if we wish to avoid a shock hazard. Since the Neoprene cable used to feed such fixtures is buried direct in the ground and, I assume, without raceway protection, it must be a Type USE cable as approved by Underwriters' Laboratories. Installations of this nature usually involve decisions, based on actual field conditions, which the local Inspector must make. He should be consulted. -B.A.McD.

Hazardous Areas

Is it necessary to consider the bottling room in a liquor wholesale house as a Class I Group D location? We have made several explosion meter readings at different times during the operation and at no time have we found any evidence of hazardous conditions being present. We understand that ethyl alcohol has a flash point of somewhere around 50° Fahrenheit, but inasmuch as no pure ethyl alcohol is handled at this plant, is it not true that mixtures of ethyl alcohol and water such as those present in all hard liquors have an elevated flash point which would not form hazardous vapor-air mixtures?-C.C.

The International Critical Ta-A bles indicate that ethyl alcohol has a flash point of 48° Fahrenheit or more. As this alcohol is cut with water, it will, of course, increase the flash point. However, a liquor rated as 100 Proof will have a flash point of about 75° Fahrenheit and should the alcohol be reduced even further to the point where the liquor might be rated as an 80 Proof liquor, the flash point would be increased about 4° or to 79° Fahrenheit. As either 75 or 79 will be below ambient temperatures during some portion of the year, it must be considered possible for vapors to be given off sufficiently fast to form a combustible vapor-air mixture in and about the bottling equipment.

The use of an explosion meter of the direct reading type to determine whether or not a specific area should be considered a hazardous Class I area is, I believe, very dangerous as even when properly calibrated it will furnish only the vapor content on the actual atmosphere sampled and will not furnish information as to the conditions which existed either prior or following the sample taking, which tends to create a sense of false security as where even large amounts of highly volatile liquids are exposed to the atmosphere, it is improbable a flammable mixture of vapor and air will exist for any appreciable length of time. In several instances explosions of vapor and air mixtures have occurred in properties where recording types of vapor analyzers have been employed for as much as 18 months prior to the actual explosion without indicating that the concentrations ever reached the combustible range.

Any volatile liquid having a flash point below the ambient temperature of the room in which that liquid is subject to exposure can liberate vapors in sufficient volume to form an explosive vapor-air mixture. It therefore would seem logical to consider any room or area as a Class I area if liquids having flash points below the maximum ambient temperature which might occur were processed or stored in such a manner that vaporization might occur.—G.R.

Threading of Conduit, Fittings, etc.

Recently several sections of a Class I, Division 1 installation were criticised by the local inspector. Mainly his criticism was with respect to the straight threading on the bosses of some of the explosion-proof fittings and the conduit couplings. Is this a code violation?—G.J.

A. In Section 5014a the second sentence states, "All threaded joint shall be made up with at least five full threads engaged."

Some inspectors have accepted threaded joints wherein five or more threads seemingly are in contact with each other. Others have criticised every joint wherein tapered threaded conduit has been inserted in couplings or fittings having straight threads in their bosses.

Rigid conduit is manufactured in accordance with the American Standard Specification No C80.1 issued in 1950. Among other requirements this standard sets up a requirement for the tapering of threads on conduit. At the time of adoption of this standard two tapers were being used by the various manufacturers for threading conduit of a inch trade size and smaller. Basically a 3 inch taper per foot was adopted. However, the following foot note was shown in the standard, "A taper of & inch per foot on 4 inch, 8 inch, 1 inch and 4 inch sizes will be accepted for a period not to exceed two years after the effective date of this standard." From now on out, since the two year period has expired, all factory threaded conduit should have a 4 inch taper foot on all its threaded ends.

It should also be noted that practically all field threading of conduits results in tapered threads. Nearly all dies used on the job are set to cut taper threads on conduit.

Conduit couplings, however, are generally supplied with straight threads. Furthermore, some couplings are slightly shorter than others (actually they may be as much as $\frac{1}{6}$ inch



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shorter). If two pieces of conduit with taper threads are screwed into this short coupling tapped with a straight thread, it may be necessary to screw up this joint so tightly to insure a tight connection between the two peices of conduit and the coupling as to actually have both ends of the conduits butt each other within the coupling and maybe upset these ends to form fins and burrs which will cut into the wires being pulled into this conduit system.

If either conduit is backed off slightly to eliminate the pressure between the two conduit ends, in many cases this will leave the conduit fitting relatively loose in the coupling. This looseness has actually resulted in arcing when ground currents flowed through the conduit system.

Even with the use of proper length couplings the actual number of threads making full contact will be about two or three threads. Some inspectors feel that as long as two or three threads do make tight contact and the balance of the threads only touch each other in spots, the electrical continuity of the conduit system is sufficient for insuring the grounding integrity of the system.

Other inspectors, however, argue that this is not sufficient contact in view of the Code calling for "five full threads engaged". They point out, further, that any slight loosening of the conduit due to vibration, or a resetting of the conduit to line up fittings, equipment, etc., tied into the conduit line, may be sufficient to set up arcing if ground currents flow. Such external arcing conditions cannot be tolerated in any hazardous location.

Manufacturers of conduit can supply couplings with tapered threads. Generally, these have to be specifically requested.

With respect to conduit fittings, i.e., Appleton "Unilets", Crouse Hinds "Condulets", etc., etc., the threads in the bosses of these various fittings are taper threaded. There are, however, some manufacturers who still straight tap thread these bosses and such fittings may cause trouble in hazardous area application. With only two or three threads contacting it is easy to set up a loose joint.

The fitting must, more or less, be installed to face in a certain definite direction so that its cover is made accessible or so that supplementary equipment may be installed on the fitting in a proper manner, i.e., a lighting fixture, for example, may be attached to the conduit fitting. With only two or three threads engaged at full make up of the joint it can easily be loosened if for any reason the fitting has to be backed off to align it properly in the conduit line. Ta-

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pered threads are, therefore, most important in these fittings, especially in view of the fact that in many of these units, cable taps, joints and terminals are to be made.

As a final word it is interesting to note that one city is actually contemplating the passing of an ordinance requiring the use of tapered couplings on conduit.—B.Z.S.

Lighting Fixture

A fixture salesman has just shown us a new type of lighting fixture which he claims has been designed to be used in a paint spray booth. It seems this fixture is fully enclosed and has an k-inch air line opening so compressed air is blown through the fixture. Can such a fixture be used directly within a paint spray booth?—K.R.C.

At the present time we have no record of such a fixture having been listed by the Underwriters' Laboratories for use within a paint spray booth. Section 5003 of the National Electrical Code states that "unless electrical equipment is specifically approved for the location, no such electrical equipment or apparatus shall be installed or used where it may be subject to hazardous accumulations of readily ignitible deposits or residues, except as follows:" and under these two exceptions they except conduit with its threaded boxes or fittings which contain no taps, splices or terminal connections and also the high voltage grids essential for the application of paint by the electrostatic spray method. While it is entirely possible that a fixture may be constructed with sufficient air velocity being passed through it to make it a safe device for use in an area where paint residues may deposit upon it, we believe it advisable to insist that the fixture be listed by some reputable testing agency, such as the Underwriters' Laboratories, before being generally accepted in the field. At the present time this same section of the National Electrical Code specifies that lighting shall be through panels of glass or other transparent material so designed that the transparent panel effectively isolates the hazardous area from the area in which the lighting unit is located.-G.R.

Grounding

Sometime ago you answered a question concerning the need for a grounded grid where lighting circuits were derived from two or more transformers whose primaries were



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"Sudden Depth" Drills
Wood Screw Anchors
Expansion Shell:
Fostening Devices

supplied from power circuits. I now have a case where power is supplied to a building through a series of delta connected transformers supplied from a 13,800 volt line. These transformers supply 440 volts to the plant. Now inasmuch as these transformers supply no other properties, is this not an isolated case where it would be unnecessary to carry grounds for the lighting circuits back beyond the service equipment as this installation is not connected or supplied from a secondary system?—R.R.

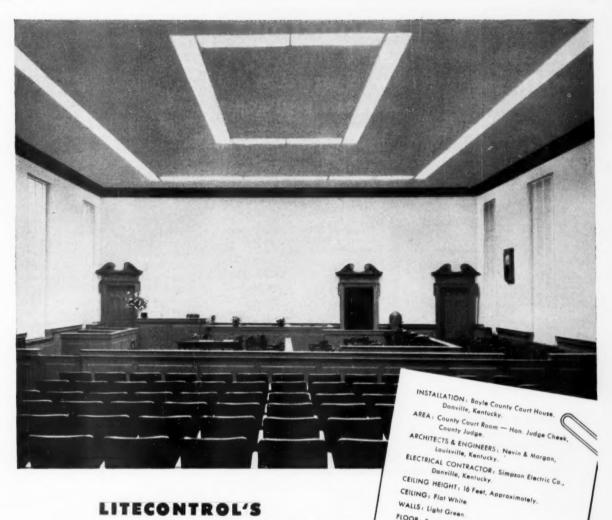
It is true that a system such as you describe is termed an "isolated" system as it is not supplied directly from a secondary distribution but is supplied instead through its own bank of transformers whose primaries are connected to the utility primary distribution. However, under Section 2526 you will find that where an interior wiring system or circuit is required to be grounded and where such a circuit or system is not connected to an exterior secondary distribution system, the grounding connection shall be made at the transformer, generator, or other source of supply, or at the switchboard, on the supply side of the first switch controlling the system. The first switch controlling the system of wiring within a building would be that switch at the service to the building which opens circuits supplying the transformers from which the lighting circuits were energized. Therefore, where two or more transformers are used to supply lighting circuits within a single building, I believe the Code requires that the neutrals be interconnected in order that they may be grounded on the supply side of the first switch controlling the system.-G.R.

De-Rating Enclosed Switches

Is it true that enclosed switches have been de-rated? If, so, is this a new Code requirement and how do you figure the proper size switch?

—J.W.

I know of no new Code requirements covering this question. Section 1120 of the Code requires electrical equipment, such as switches to be marked with a rating giving the voltage and the current for which the switch is designed to handle. Section 93801 also requires a switch rated in horsepower to show the maximum rating for which it is designed. The term "maximum" is only used in connection with horsepower rated switches.



LITECONTROL'S

CASE OF THE MISSING SHADOWS

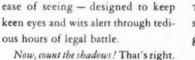
trasts or tiring glare.

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louvared troffers, using 11296 slimline lamps.

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Examine this courtroom carefully.

Note the even illumination . . . the





FLOOR: Brown Cork.

SPACING: 8'-6" on centers.

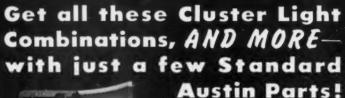
FIXTURES: Litecontrol No. 5828 2-lamp recessed

INTENSITY: Approximately 37 footcandles average

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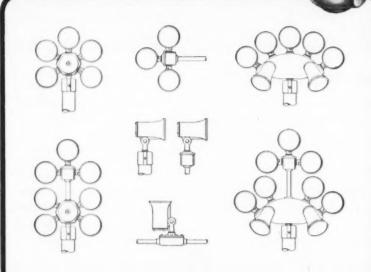
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The M. B. Austin Company NORTHBROOK ILLINOIS During the past year however, Underwriters' Laboratories have recognized in their Standard for Enclosed Switches, the distinction which occurs when a switch is used continuously at full rated current. The new U. L. provision reads as follows:

A fused enclosed switch shall be marked, as a part of the electrical rating, "Continuous Load Current Not to Exceed 80% of the Rating Of Fuses Employed In Other Than Motor Circuits,"

This new provision also applies to service equipment consisting of a single, fused switch.

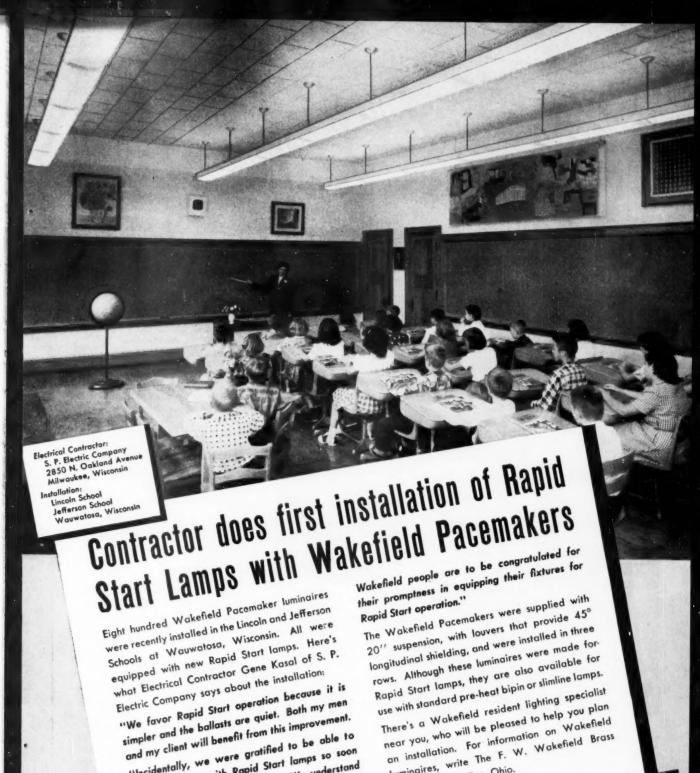
In line with the foregoing, a 400 ampere switch with 400 ampere fuses would have a general rating of 400 amperes but if the switch was subjected to full load continuously it would have a rating of 320 amperes. It also appears to me that a 400 ampere switch with 300 ampere fuses would only have a continuous rating of 240 amperes. While I do not believe this was intended, it appears to me that the wording should be changed to clarify this point if we wish to avoid confusion in applying this rating which will appear on enclosed switches.

While I am in complete accord with the objective to be attained by the new rating, it appears to me that the double rating may result in controversy. Since the interpretation of the words "Continuous Load Current" may mean the difference in a switch size, it is quite possible on competitive jobs where specifications are not definite, that this point may be difficult for an Inspector or Contractor to decide.—B.A.McD.

Equipment In Hazardous Locations

Recently we had an outdoor Class I, Group D, Division 1 installation which was subject to much weather (rain, etc.), and also severe corrosive conditions, turned down by an inspector. He particularly condemned the use of junction boxes of the types similar to the ground joint "Condulets" of Crouse Hinds CPS Series and "Unilets" of Appleton FGS Series. He stated these were not approved for such locations. Wherein does the Code prohibit the installation of such approved equipment outdoors?—H.I.I.

A. In Section 5002 the first sentence states "The intent of this article is to require a form of construction of equipment, and of installation that will insure safe performance under



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supply fixtures with Rapid Start lamps so soon after they came on the market. We understand that this installation of Wakefield Pacemakers with Rapid Start lamps is the first anywhere. I feel the Luminaires, write The F. W. Wakefield Brass Company, Vermilion, Ohio.

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conditions of proper use and maintenance."

In the Hazardous Location Electrical Equipment List issued by Underwriters' Laboratories Inc, the following general statement is made with reference to the electrical equipment listed for such locations.

"The equipment is intended for use indoors where severe corrosive conditions are not likely to be present."

A combination of these two requirements would definitely rule out the use of the particular fittings in question. To explain, for example, turn to the Crouse Hinds catalogue No. 3000 issued November 1, 1949 to page 8 of Section G. We see that these fittings are approved for Class I, Group C and D, Class II, Group E, F and G and Class III installations. No further notations are shown so that these are approved in accordance with the UL general listing only, i.e., for indoors.

As a contrast, note the listing of the screw thread fittings of the GUA series on page 1 of this same section of the catalogue. The class approval is the same as for the CPS Series. However, the general title for this GUA Series shows that these fittings in addition are "Weather Resistant (Raintight)". These, therefore, may be used outdoors.

Assuming that these standard GUA fittings are also capable of withstanding the effects of the local severe corrosive conditions they would be approved for this installation. It is possible, however, that even these fittings which are approved for outdoor use could not withstand the corrosive effects for this local installation since the corrosive fumes would attack the ferrous fittings. In this case these GUA units may have to be made of aluminum, brass, bronze, lead or furnished with some special finish to withstand both weathering and the highly corrosive vapors.-B.Z.S.

Transformer

Our attention has been called to a safety bulletin which recommended the use of an isolating transformer as a source of supply for a trouble lamp to be used inside of tanks or boilers for repair and maintenance work. Does the Code at the present time accept the use of an ungrounded circuit for the supply of a lamp outlet?—B.R.

At the present time the National Electrical Code does not accept the use of an ungrounded circuit for the supply of 115 volt lamp circuit. However, it is entirely possible that at some future time a change may



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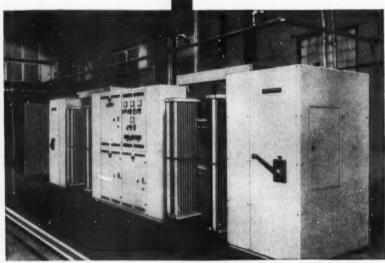
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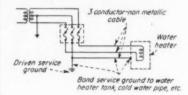
be made in the National Electrical Code to provide for such practice. At the present time standards prepared by the National Fire Protection Association, the same organization which sponsors the National Electrical Code, does recommend the use of an isolating type of transformer and ungrounded circuits supplying all lamp outlets and other devices utilized in rooms of a hospital where combustible anesthetics are employed. These same standards also require the use of a ground detection device on such circuits. Therefore, if a ground detection device is available for use in a circuit of the ungrounded type supplying a trouble lamp for use in tanks or boilers and the transformer is of the type which is truly isolating, there is no question but what the installation would be safer from the electric shock hazard than the conventional grounded circuit type. However, as yet it is not recognized by the Code, making it necessary that the inspection authorities having jurisdiction be consulted before any attempt is made to install such a system.-G.R.

Grounding—More of the Water Heater Situation

On Page 154 of the September issue of EC&M, the wiring diagram which illustrates your interpretation, shows a three wire, nonmetallic cable leading to the water heater, one of the conductors serving as the ground wire. If we assume that, for a small heater, these conductors would be No. 12 gauge, wouldn't this be a violation of order 13-2594, which requires that, for services, No. 2 and smaller the service grounding conductor be at least No. 8?

Also wouldn't this method of grounding introduce a hazard of its own, considering that a conductor as large as No. 4 is known to have been burned off by lightning, and if the service ever has to dissipate a lightning stroke, the wire to the heater may very well carry the larger portion of the current.—

A. First off I would like to state that the diagram shown is actually but a generalized sketch and does not attempt to give all details. If



CRESCENT WIRE TOO OO CIN GOOD RIFT TO COVER WAS OUT OWNER 1407 Broadway Realty Co., N. Y. C. ARCHITECT Kahn and Jacobs, N. Y. C. CONSULTING ELECTRICAL ENGINEERS Smith & Silverman, N. Y. C. GENERAL CONTRACTOR H. Taylor Construction Co., Inc., N.Y. C. ELECTRICAL CONTRACTOR Miller-Brown, Inc., N.Y. C.

this were an installation with only a water heater installed to the service switch directly as shown by the drawing then the service wires could be as small as No. 12 for the entrance conductors (see Section 2304a3) and the switch could be as small as 30 amperes (see Section 2357). The ground wire, however, would have to be at least No. 8 (see Section 2594a).

If the water heater is installed as one of several branch circuits then the service ground is determined for the service switch according to Sec-

tion 2594.

The use of the third wire in the NSMC for tying in the water heater non conducting metallic casing, however, is not dependent upon the service switch grounding, but actually is a matter or bonding between the service switch ground or some other convenient electrode and the water heater casing. The size of the conductor for this bonding or supplementary grounding of equipment only, is governed by section 2595. Here it will be seen that if the branch circuit overcurrent protection is 20 amperes (assuming a three wire No. 12 circuit as you do) is used to feed the water heater, then the grounding conductor will have to have a minimum size of No. 16. So using this third wire of No. 12 size will be ample for this supplementary grounding.-B.Z.S.

T.V. Installations

Q. Does the Code cover T. V. installations as to lightning arresters and types of antennas for heavy loading areas, plus the distance from service drops?—P.Z.

Article 810 of the Code, under the title of Radio Equipment, covers television receiving equipment and Sections 8111-8135 covers Antenna installations and also clearances required. Sections 8141 and 8142 covers Lightning Arrester protection.

In addition to the foregoing, the National Fire Protection Association have published an article prepared by Charles L. Smith their Electrical Field Engineer on the subject of Television and FM Antennas. This article has 18 illustrations covering antenna installations, grounding and arrester location. All pertinent Code rules are quoted and their application explained. I sincerely recommend that you obtain a copy of this excellent paper. It is available at a cost of 25 cents. Write the National Fire Protection Association, 60 Batterymarch Street, Boston. Mass. and ask for pamphlet No. Q 45-1.-B.A.McD.

Maximum Loading Of Conduits

What violation, if any, can you find with this type of installation, Fig. 1? The type of installation used is shown in Fig. 2. A competitor said he could have done the job cheaper with Fig. 1 installation. My contention is that the 2½-inch raceways are too small for the number and size conductors used. I believe he would have to use 2-3 inch runs and the cost would be higher than Fig. 2 installation.—P.P.G.

According to Tables No. 12 and No. 13 of the Code, the 21-inch conduits shown in Fig. 1 are too small for the area of the conductors involved. The mathematics are as follows:

Sq. inch area of $2\frac{1}{2}$ inch conduit is 4.79 sq. in.

40% of 4.79 is permitted for conductors 1.916 sq. in.

Area of 1—250 M C M—RH—conductor is .5917 sq. in.

Area of 3—250 M C M—RH—conductors is 1.7751 sq. in.

Area of 1—No. 3 R H conductor is .1817 sq. in.

Total area of the conductors is

1.9568 sq. in.
Since the total area of the conductors, 1.9568 sq. in., exceeds the permissible area to be used, 1.916 sq. in., there is a code violation.

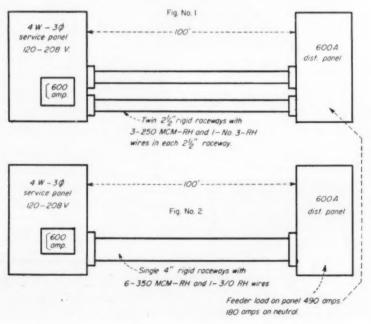
In line with the above method, I find in Case No. 2 that the 4 inch conduit is sufficient in size for the conductors shown. 40% of a 4 inch conduit is 5.09 sq. in. The total con-

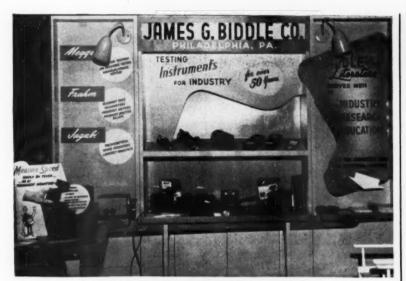
ductor area is 4.987 sq. in. Due to the 80% penalty involved for more than three conductors in a raceway, Fig. 2 has 14 amperes less carrying capacity than Fig. 1. The conductors of Fig. 2 have a capacity of 496 amps. and the conductors of Fig. 1 have a capacity of 510 amps. Current in the neutrals has been disregarded in both cases in view of note 5 following Tables 1 and 2, with the assumption that the provisions of the note are satisfied. If the note is not satisfied, further penalties would be involved and both of the two proposals would have a current carrying capacity of less than 490 amperes.—B.A.McD.

Range Wiring

In the book "Practical Electrical Wiring" by Richter, Page 181 (1947 edition) it says an electric range requires a separate circuit except that the Code permits a water heater to be included on the same circuit. Where does the Code give this permission? I mentioned the above and I now need some backing rather badly.—L.R.

Section 2126-c permits a fixed range and a water heater to be connected to a 50 ampere branch circuit with no restriction as to occupancy. It also follows, however, that this combined load does not exceed 50 amperes and that the circuit is wired with at least No. 6 conductors. To my knowledge this method has been used very little.—B.A.McD.





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Demand—Lighting and Power

A factory has a 1200-amp lighting load at 120 volts and a motor load (name plate rating) of 820 amperes at 208 volts, 3 phase. One service is used-4 wire 120-208 volts. The largest motor is a 220 volt 40 hp squirrel cage motor full voltage starting. Lighting load is to be balanced on the 4 wire 3 phase. The entire factory is to move completely to a new community and a new building of the same square foot area as the old building. A thorough survey reveals that the demand on the lighting is only 60% of connected load. A thorough survey revealed that the power load (motors) had a demand of only 38% of the connected load. Necessary meters and recording devices were used to make survey. What is the minimum size feeders (service) and minimum sized fused switch (or switches) permitted for the service? Must the entire connected load be used in determining service feeders and service switchgear or can the demand factors be applied?-P. P. G.

According to the Code, the general lighting load in a factory occupancy is computed in line with the requirements of Section 2116 and 2203. Reference to Section 2203-a shows a Table which lists the occupancy, the demand factor permitted and the minimum watts per square foot that must be used when computing the lighting feeder size. For an industrial occupancy, the demand factor for general illumination is 100%. The total connected load must be used. In the example under discussion where the lighting load is 1200 amperes, served by a three phase, four wire star connected service, the feeder must be computed on the basis of 400 amperes per phase assuming that the load is equally balanced over the three phases. This is a Code requirement and I may also add, as the Code warns under Section 2203 and Section 2116 that these provisions are minimum requirements and do not cover conditions where power factors, less than 100%, are encountered; and where the loads are usually connected for long periods of time. In addition, voltage drop is not recognized in the computation and any deviation from the requirements which lowers the 100% demand factor would decrease the factor of safety, which past experience definitely proves, must be considered in the design of

In calculating the motor load, Sections 4314 and 4315 of the Code requires the total connected load to be used when figuring feeders or services.



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Section 4316 however does permit demand factors to be used, by permission of the authority enforcing the Code, when operating conditions or the duty cycle is such that reduced heating of the conductors would result. In view of the variables involved with this problem, it is impossible to set up definite demand figures and each case must be separately investigated and judged in line with all conditions involved.

In the case in question, you say that a survey of this motor load indicates a demand factor of 38%. While I am not familiar with the details considered with the survey, it is my opinion that such a demand figure should not be permitted unless the conditions of plant operation are such that all motors never will operate at full load at one time and when the connected motor load exceeds 38% of the total load the character and duty of the loads are such that the conductor heating effect would not exceed that permitted for the type of conductor insulation involved. Here again, consideration should be given voltage drop, power factor and the factor of safety which should be considered in the design of services and feeders. Past experience has proven to me that too much stress on economy in wiring design too often results in false economy and the savings which appear so desirable at the start very often, in a short period of time, are eaten up, four or five times by the additional investment required to compensate for a wiring job which refused to recognize reasonable adequacy. Past experience, time and time again, has proven this point and all of us who are concerned with the electrical wiring industry have been condemned for lack of foresight in our planning when such conditions develop. In the absence of detailed information concerning the nature of the plant operation and the survey. I cannot hazard a guess regards the demand factor that might be recognized by the Code.

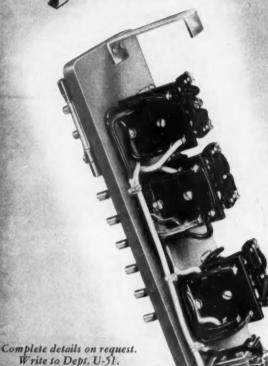
I hope that the foregoing comments however, indicate that very little, if any, consideration should be given this matter. The question must be decided by the authority enforcing the Code in your locality.

A summary of the foregoing remarks indicate that the feeder supplying the lighting load should be, at least, of a size sufficient to carry 400 amperes at 100% power factor.

The motor feeder should preferably be capable of carrying the total connected load. Any deviation must be with the consent of the authority enforcing the Code. Power factor, voltage drop, voltage of motors, loading, nature of operation, all should be considered.—B. A. McD.

No Other Alarm System Has ALL The Advantages Of

JNILARM

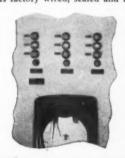


1. Provides unfailing supervision of equipment and process operations.

- 2. Precision-built to Underwriters' Laboratories requirements. Completely wired and tested . . . ready for field connections.
- 3. Plug-In Panel (large illustration), fits inter-changeably into Explosion-Proof, Vaportight and General Purpose enclosed units. Reduces maintenance to a minimum , . . easily and quickly replaced with a spare unit.
 - 4. Your choice of 100 standard circuits to suit every conceivable application.
 - 5. Distinctive visual signal for each condition (flashing light) insures immediate attention.
 - 6. Any number of Unilarms may be connected to one audible signal.
 - 7. Tried and tested in the field. Thousands in use giving trouble-free protection. Accepted as standard by leading industries.
 - 8. Available as individual unit or in multiunit Panels. Also time delay types for applications subject to high surge or excessive vibration.
 - Saves space, engineering costs, installa-tion and maintenance over other alarm
 - 10. Acknowledgement-test switch permits periodic testing of each Unilarm circuit.

*Reg. U.S. Patent Office,

Special Explosion-Proof Unilarm Panel showing stock units, group mounted. Panel is factory wired, sealed and tested.











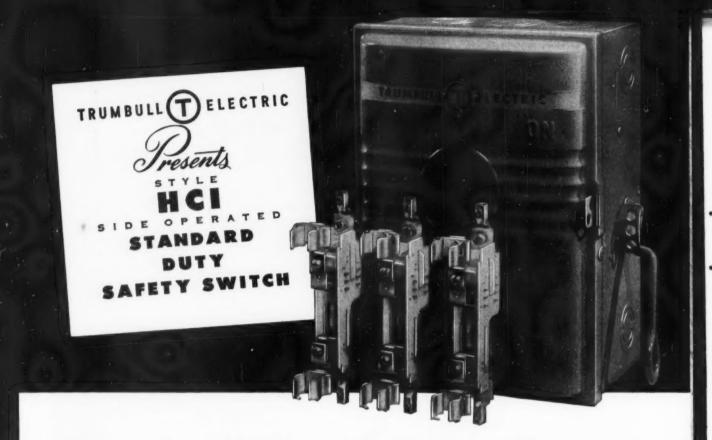
Vaportight Unilarm General Purpose Unilarm

R&S Unilarm is also available in a complete line of Surface Mounted Types - Explosion-Proof, Vaportight and General Purpose.



RUSSELL & STOLL COMPANY, INC. . 125 BARCLAY STREET, NEW YORK 7, N.Y.

PRECISION BUILT ELECTRICAL EQUIPMENT - SINCE 1902



Trumbull Top Quality Features AT 'TYPE C' PRICE

If your safety switch requirements call for normal usage and load conditions, your Trumbull wholesaler can show you a new high in value.

Check the factors that are important to you—complete safety, rapid wire-in, simplified service, compactness. You'll find them all in this new, completely Underwriters' Laboratories Approved switch line.

Inspect the pole units, the heart of any switch. They are identical with the advanced quick-break, arcquenching design used in Trumbull heavy duty HCI switches. Notice that all current carrying parts are silver plated. Try the positive ON-OFF action. Look at the sturdy enclosure with full overlapping cover flange.

Here's assured safety and dependability in a quality switch at a price which spells economy in your purchasing . . . without resorting to "off-brand" substitutes.

Leading Electrical Distributors everywhere stock Trumbull equipment. See your local Trumbull Distributor for top values and alert service. For complete descriptive literature, write us

Quick Facts ...

About Style HCI Side Operated Standard Duty Service Switches

CAPACITIES: 30, 60, 100 and 200 amp., including 2- and 3-pole, 3- and 4-pole (solid neutral), and 4-pole in 30 through 100 amp., fusible and no fuse; 240, 480 and 600 volt A.C.. 250 and 600 volt D.C... all H.P. rated. Meets NEMA Type A Specifications.

SAFETY FEATURES: Provision for padlocking enclosure catch and handle in either position. Clear ON-OFF marking on cover and interior.

MOUNTING: Unusually compact. Can be closely ganged (200 amp. switch requires only $4\frac{1}{2}$ " between sides). Ring handle can be hook stick-operated if in high mounting.

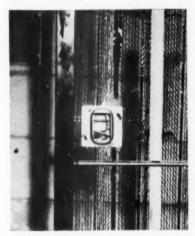
TRUMBULL ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY
PLAINVILLE, CONN.

Practical Methods



OUTLET BOXES are anchored to the metal lath by means of an iron rod run through the box. Rod is tied to the metal lath with iron wire.



SWITCH OUTLET box is fastened securely to metal lath at door frame, using an iron rod run through the box which in turn is anchored to the lath.

Outlets in Thin Walls

Where the walls are so thin they scarcely cover an outlet box, the problem of anchoring the box to the metal lath in a satisfactory manner was worked out by Emory & Bohm Electric Co. of Portland, Oregon, in the wiring of the Ione Plaza apartments, a 13-story structure.

Holes were drilled through each side of the outlet box and a short piece of

iron rod run through the box and tied to the expanded metal lath by means of iron wire. Holes were cut in the metal lath just the size of the box. This permitted the box to be centered at the line of the lath itself. Then the plaster on either side made the thickness of the wall. The plaster coat barely covers the back of the box and runs to the plaster ring on the front.

In this type of construction the floor slab also is too thin to permit the burying of the conduit in the slab. Hence E. J. Bohm, who supervised the job, often ran a length of gutter along the wall line and made short conduit taps up to the outlet boxes.

In the kitchens where the circuit breaker panel for each apartment was located the wall was not sufficiently deep for the circuit breaker panel enclosure. Hence, at such locations, the metal lath was extended back of the cabinet for an offset in the wall.

Gellophane Jackets Preserve Data Sheets

-OFFICE METHODS

Data sheets are important tools to the man in the electrical construction and maintenance industry. By providing pertinent information in a condensed, easily accessible form they contribute as much to the overall efficiency in performing a service, whether it be estimating, engineering,

installation or equipment repair, as the actual tools used in the field. As such, they deserve the same consideration when it comes to preservation and care.

Sheets subject to frequent reference (man-hour data, dimensional information, repair and replacement parts listings, wiring and connection diagrams, equipment catalog sheets, etc.) often become soiled, torn or damaged. The information is hard to read and sometimes totally illegible. This is particularly true when sheets are filed in the shop area or field offices where clean hands are the exception rather than the rule and dirty and oily surfaces will quickly soil and obliterate the copy on data sheets.

Ross E. Waite, president, Monarch Electric & Supply Company, motor repair shop and electric supply organization in LaSalle, Ill., solved the problem by enclosing such data sheets in cellophane jackets punched to fit the loose-leaf binders. Now mechanics need not hesitate to use the data sheets with dirty hands. Grease, oil and dirt can be quickly removed from the protective jacket with a damp cloth. And the sheets retain their new look. Waite found that cost of cellophane jackets proved to be a highly economical investment.



IMPROVED METER STORAGE system developed at the Blackstone Valley Gas and Electric Company, Pawtucket, R. I., uses adjustable (Unistrut) steel channels and fittings. The three-section structure holds 672 meters (224 per section) which are hung on round-head machine screws held by Unistrut nuts in horizontal channels. Mounting screws can slide to any desired position to provide fast, space-saving storage and accurate meter selection.

A Journeyman's Tool, built to stand up under constant, on-the-job Contractor or Industrial use



• NO STARTING HOLE NEEDED...Simply place guide next to material and "rock" tool into an upright position.

• CUTS RIGHT THRU IMBEDDED NAILS . . . wood, plaster, iron pipe, sheet metal, "Transite" and most other materials—even in cramped quarters.

• FITS ANY HEAVY DUTY 1/4" or 1/4" DRILL...as easy as changing bits! Overall length only 10 1/4"; weight only 3 lbs. 6 ozs.

● ANTI-FRICTION REPLACEABLE BEARINGS—BUILT-IN BLOWER... Blower keeps tool comfortably cool even under continuous use—blows dust and chips away from cutting line. All friction surfaces are of "Oilite," phosphor bronze or high speed ball bearings. All wearing parts are replaceable.

Write for Bulletin No. Y-1

R.C.S. TOOL SALES CORPORATION Joliet, Illinois, U.S.A.

Federal Procurement Officials will find Super Saws listed in Federal Supply Schedules, Class 40 Materials.

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the Emblem of Quality
in signals and systems



You want the best there is—from a simple push button to a complex signal system. For more than 77 years Faraday has supplied home and industry with the finest electrical equipment. Consult your electrical wholesaler for details on the complete Faraday line.

HOLTZER-CABOT FARADAY STANLEY & PATTERSON

CONSOLIDATED BY

SPERTI FARADAY INC. ADRIAN, MICH.

BELLS BUZZERS HORNS CHIMES VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS

Handy Kinks For Shop Work

MECHANICS

Two handy kinks for shop work have been found worthwhile by Thomas Trail, Catonsville, Md. One has to do with loosening taper pins and the other with maintenance of drills and taps.

As shown in Fig. 1, taper pins can be quickly loosened using an arrangement of nut and washers. When taper

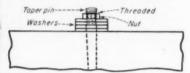


FIG. 1. Taper pins can be quickly and easily removed by using the pressure of a nut against some washers placed over the threaded pin end.

Cutting opening in oak flooring in less than 3 minutes no starting hole needed?

pins are found difficult to loosen, thread the large end of the pin with a regular die or a rethreading die. Take the threads down as far as possible. Then place some washers or a small pipe sleeve over the threaded pin end leaving at least a half-inch of the threads exposed. By taking up a nut on the threaded end, pressure can be brought to bear on the washers and a lifting force is exerted on the pin. Easily and quickly the taper pin can be removed.

Fig. 2 shows a method for cleaning tap threads and drill flutes. An old

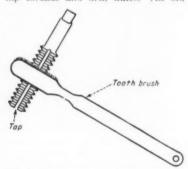


FIG. 2. Tap threads and drill flutes can be cleaned after each use with an old tooth brush dipped in a solvent. Keeps tools in good condition.

tooth brush, dipped in varsol or some other solvent, is used to brush the chips and metal dust from the threads or flutes. By having the tooth brush available, this maintenance method can be applied to all taps and drills right after each use. This has been found an advantage in keeping these tools in good condition.

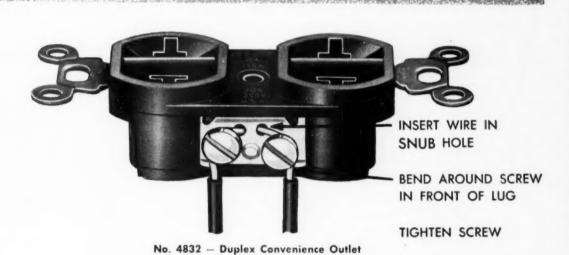
Keeping an old tooth brush handy in the shop also provides a quick and easy means of cleaning many small electrical components in tight places. Easiest, most secure way to attach conductors

THE ANSWER IS

BRYANT

WIRING DEVICES

New "Hole-Snub" Wiring



ADDITIONAL FEATURES -

- Device has staked terminal screws-backed out
- Large head screws permit use of wire up to and including No. 10
- Double-sided contacts
- "T" Slots
- · All-plastic body available in brown and ivory



Listed by Underwriters' Laboratories, Inc.

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

Chicago . Los Angeles

J-99884



Brand new 3200 line... Fits one gang switchbox!

125V.T. Brown

or Ivory.

No. 3200 — Single Pole T Rated S witch and double contact receptacle. Separate Feeds. Switch 5A.-250V., 10A.-125V.T. Receptacte-10A.-250V., 15A.-125V. Brown or Ivory. No. 3201—Common Feed.



NEW JERSEY



SUBMARINE CABLE was laid from supported reels on barge; was guided over end of barge by two-by-fours. Installation was supervised by diver.

Laying Submarine Cable

_WIRING

A barge, crane, construction crew and diver were combined in a working operation to properly install two parallel lengths of submarine cable in the electrical construction on Eastern Boulevard Bridge, Bronx, N. Y. Installation of the cables was made by the Johnson Electric Corp., New York, N. Y. The two cables contain circuits for operating the draw span, traffic signals, gates and navigation lights on the bridge.

Weighing over two tons each, the 250-foot lengths of cable contain 60 control and two telephone circuits. The cables were laid from reels on the barge. The reels were mounted from supported axles which allowed turning of the reels to pay out the cables. At the points at which the cables went over the barge end, two-by-fours were used to guide them. The details of the installation required the combined efforts of a crew on the barge and a diver who supervised from underwater the laying of the cable in a prepared trench. The special cables themselves were supplied by The Okonite Company, Passaic, N. J.

Tires Cut Maintenance Of Airport Lights

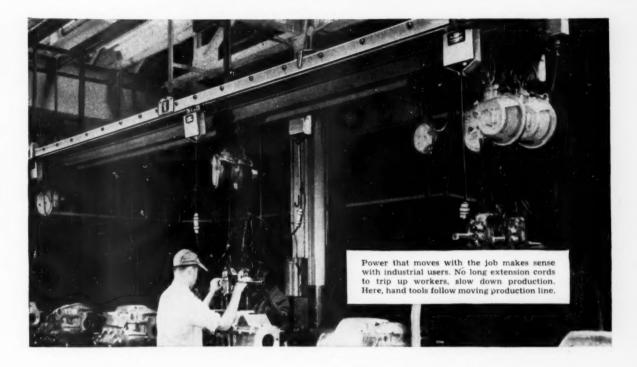
MAINTENANCE

Here is a clever and inexpensive idea for airport maintenance electricians. Discarded auto tires placed around the threshold (range) lights at all the runway ends at the Birmingham Municipal Airport have reduced the breakage of these lights when they are knocked down by planes or grass mowers. Before the tires were used 35 lights were broken in three years time.

An easily-breakable coupling at the base of each light is intended to break



TRENTON 4





Industrial Trol-E-Duct with tap-off outlets in boxes feeds motors on a moving test line. Power where it is needed.



Heavy-duty mobile hoist is fed from trolley moving in duct. Trolleys are available for virtually any load requirement. Easy to install.

Production <u>rolls</u> when power supply rolls with it!

BullDog Industrial Trol-E-Duct lets power feed go right along with the job
... is easy for you to install!

Where production equipment must move freely, Industrial Trol-E-Duct provides the means. This easy-toinstall, highly flexible system of electrical distribution not only carries current to the job, but supports heavy tools. Rated at 100 amperes.

Trolleys, riding overhead in continuous duct slot, tap power from enclosed bus bars and relay it to portable power tools, hoists, cranes and other moving "loads." Your customers get power that rolls right along with the job... mobility that means extra production. Users report savings up to ½ hour per shift.

Entire system is prefabricated, standardized for easy installation. Dismantles and reinstalls swiftly, speeds up plant change-overs. Completely salvable, safe, efficient, guaranteed.

Get the complete story on Industrial Trol-E-Duct. Contact your Bull-Dog Distributor, or write direct for free Bulletin IT-655.



This slot is the secret of mobile power. Through it, Industrial Trol-E-Duct provides a continuous power outlet.



Cross section of Duct and trolley. Steel wheels and spring-button contacts assure smooth-rolling, positive-contact trolleys.



BULLDOG ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO PIONEERS IN FLEXIBLE ELECTRICAL DISTRIBUTION SYSTEMS





OLD AUTO TIRE is placed around Line Material high intensity threshold light at end of runway on Birmingham Municipal Airport to prevent breakage when knocked down by plane or grass cutters. Holding tire is James O. Bennett, building custodian at the Birmingham Airport for the past 23 years.

when the light is struck—thus minimizing damage to the plane and the light. Now, the coupling breaks when the light is struck and the tire prevents breakage of the light on the concrete base. The tires also protect the lights from breakage when grass cutters or mowers are run too close to them. They are painted bright yellow to increase their visibility and marking.

All the runways at this airport are completely lighted with the Line Material Company's high intensity lights—for safer and easier operation under all weather conditions.



MULTIPLE ELECTRODES on 125 kva, press-type resistance welder speeds production of portable lamp guards at McGill Manufacturing Company's electrical division in Valparaiso, Indiana. Three double-electrodes in welder head make six spot welds on the half-cage assembly at one stroke. Fixture is shifted 90 degrees and remaining six welds are made at second stroke. Two-man team (one man places wires in fixture; second man operates welder) completes 2100 half-cage assemblies in an 8-hour day—considerably more than formerly produced by single-electrode welder setup.

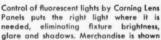




Installation: Emporium Store, Stonestown Development Project, San Francisco

Architect: Welton Becket and Associates, Los Angeles

Fixture Manufacturer: Haluk Lighting and Manufacturing Co., San Francisco



In true color. Pyrex Lenslites affset incandescent light beams, highlighting rugs hanging on the walls and adds dramatic interest to the over-all display.



A combination of incandescent and fluorescent light is achieved in these unique circular fixtures. The incandescent source in the center is surrounded by fluorescent lamps and the two sources are blended into a uniform light through Alba-Lite.



Here's ladies' wear, silverware and gifts look their best because Corning Lens Panels direct true-color light to individual counters while Pyrex Lenslites provide highlights for contrast. Notice how the fixtures blend with the over-all modern appearance of the area.



Direct beaming of incandescent light is exceptionally important in the beauty shop. Pyrex Lensiites do this in a particularly effective manner, while adding to the decor of the shop itself.

How this store got exactly the right lighting for each department

Each department in the new Emporium in San Francisco is lighted to do a special job...show off various types of merchandise to best advantage.

For example, where control of fluorescent lighting is required, Corning Lens Panels provide the precise answer. Water-white crystal glass lenses transmit true color, eliminate shadows and glare, minimize fixture brightness.

In some locations, such as the rug department, Corning Lens Panels are combined with Pyrex Lenslites which direct incandescent light in offset or spot light beams to highlight individual items.

Where highlights alone are desired,

Pyrex Lenslites are used by themselves. Or they are combined with Corning Alba-Lite for use in such locations as the Boys' Department where display lighting plus soft overall diffusion of fluorescent lighting is indicated.

Wherever used, Corning engineered lightingware not only adds to the sales appeal of the merchandise, but beautifies the store itself . . . gives it a sparkling, up-to-date appearance. Booklet LS-32 is packed with helpful data and describes Corning's complete line of engineered lightingware. A copy is yours for the asking. Use the coupon.

Corning Glass Works



CORNING, NEW YORK

Corning means research in Glass

CORNING GLASS WORKS, Dept. EC-1, Corning, N. Y.

Please send me Bulletin LS-32 describing Corning's full line of Engineered Lightingware.

Name____Title____

Firm_____

Address

City_____Zone___State___





Designed by Herbert G. Moore, 1.D.1., using Leader TROFFERLITES with egg-crate louver. Photos by Nowell Ward & Associates.



Interiors of Distinction

■ Leader fine lighting fixtures are at home in the most distinctive interiors . . . and as efficient in operation as they are beautiful in appearance. The finest in modern design, precision engineering, and skillful fabrication from highest quality materials, characterize all Leader fixtures.

Two of Leader's most popular fixtures for use in fine interiors are the recessed TROFFERLITES and the OFFICER series. A wide range of models in each series provides greatest flexibility in meeting individual lighting requirements.

Ask for full information on these and other Leader units for business and industry. Put Leader lighting to work for YOU!

Sold and installed by the better electrical wholesalers and contractors

resalis of all fine Leader fixtures. le in 12" or 24" width, regular or depth, in lengths from 24" to 96" of shielding: plastic or steel louver, iffice, specialized glass enclosures, Lucite plastic "Lenspanel." Also

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P^L America's No.1 Lighting Equipment Manufacturer

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Modern Lighting



GENERAL OFFICE AREAS of Balfour-Guthrie, Ltd., Portland, Oregon have been modernized with continuous row fluorescent luminaires which provide 65 footcandles average over entire first floor.



LOW CEILING of second floor required use of ceiling-type luminaires which provide average of 50 footcandles. Use of high reflection paint on walls, columns, and ceilings improves visual environment.

Continuous Fluorescents Modernize Offices

The general offices of Balfour-Guthrie, Ltd. in Portland, Oregon have been modernized and greatly enhanced in appearance by relighting and repainting. Both have contributed to a much improved visual environment, and make seeing and working much easier.

General offices of this old and long established firm occupy two floors of the building which they occupy. The first floor has a high ceiling broken with structural beams over columns, running lengthwise of the building. These beams form natural bays 18 feet wide, which extend unobstructed from one end of the building to the other. Two continuous rows of 2/40 watt DayBrite Viz-Aid louvered general diffuse type fluorescent luminaires were installed in each bay area, suspended 27 inches from the ceiling to the top of the units. This layout results in 2.6 watts per square foot, and

measured lighting intensity after more than 100 hours of operation averaged 65 footcandles at desk top level.

The second floor ceiling height is only 11 feet, and the ceiling is broken up by beams running at right angles. Acoustical tile with a high reflection factor covers the entire ceiling between beams. Because of the relatively low ceiling, 2/40-watt fluorescent luminaires of the Day-Brite ceilingmounted Viz-Aid units were installed on this floor. Individual four-foot units were joined to form continuous rows 16-feet long each, which are fitted in between the heavy beams on approximately 10-foot centers. The measured lighting intensity, after more than 100 hours of operation, averaged 50 footcandles at desk top level on this floor.

Formerly the walls, columns, woodwork and furniture were dark colors. The ceilings and beams have been repainted flat white, and columns and side walls are repainted in lighter colors with reflectances above 55%. New floors of lighter finish have been laid, and all of the furniture has been refinished to provide better light reflection. Brightness contrasts throughout have been reduced to a comfortable minimum. The diffused quality of the fluorescent lighting is thus combined with the brighter finishes of all exposed surfaces to provide a high degree of seeing comfort.

The electrical contractors on this installation were the Adams & Rankin Electric Company, Portland. They initiated this lighting prospect, and called in Ray Kamnitz, DayBrite representative, for engineering and sales assistance.

Concealed Equipment Lights Banking Area

Recessed troffers and cove lighting were combined to provide approximately 50 footcandles of illumination on the teller's deal plates in the Lincoln First Federal Savings and Loan Association, Spokane, Washington. Used in conjunction with white ceilings and light green walls, these two modern lighting techniques create a balanced brightness in the visual field. The entire lighting design concept, including the decorative treatment of the room, represents a modern lighting trend toward concealment of lighting equipment and use of higher reflectance finishes on ceilings, walls, floors,

mound ELECTRICAL CONSTRUCT AND MAINTENANCE

Lighting Competition For Electrical Contractors is being sponsored by ELECTRICAL CONSTRUCTION AND MAINTE-NANCE to provide wide industry recognition for sales initiative and application of modern lighting technology by electrical contractors . . . and to stimulate interest in the expanding opportunities for lighting progress.

A total of 18 awards will be given for those entries which are considered best by an independent board of five judges. The following have accepted appointment to the board of judges:

> Carl Zersen, Chairman Managing Director Chicago Lighting Institute Chicago, Ill.

> > Richard Kelly Lighting Consultant New York, N.Y.

Everett M. Strong Professor of Electrical Engineering Cornell University Ithaca, N.Y.

> Joseph S. Schuchert Commercial Sales Manager Duquesne Light Company Pittsburgh, Pa.

Willard Thompson, P. E. Consulting Electrical Engineer Thompson Engineering Company Boston, Mass.

Entries will be judged on sales effort, practical or aesthetic customer benefits, effective use of industry aids, lighting adequacy and design and artistic appearance.

Competition closes midnight, August 1, 1953.

Winners will be publicly announced as soon thereafter as the judging can be completed.

CONTEST RULES

I. WHO MAY COMPETE:

Any individual who is either the owner or full-time employee of a regularly established electrical contracting firm may compete for an award.

II. WHAT IS TO BE SUBMITTED:

Each Entry shall cover one or more of the

- (1) A lighting technique for a single specific visual requirement.
- (2) A specific area (large or small) lighting installation.
- (3) An over-all lighting installation for an entire building or general area.

Lighting installations eligible for Entry include:

- (1) Store interiors
- (2) Schools and offices
- (3) Industrial buildings
- (4) Residences
- (5) Floodlighting
- (6) Miscellaneous: banks, museums, libraries, etc.

III. HOW, WHEN, AND WHERE ENTRY IS TO BE SUBMITTED:

To be eligible for an award consideration,

each Entry must be submitted with an Official Certification Form and in an Official Entry Folder, which may be secured by writing to

Lighting Competition Chairman Electrical Construction and Maintenance 330 West 42nd Street New York 36, New York

Entries may only be submitted with a completed Official Certification Form and in an Official Entry Folder, mailed to the ad-dress immedately above. To be eligible for award consideration, a

competition Entry must be postmarked not later than midnight, August 1, 1953 and must be received by August 10, 1953.

IV. GENERAL REQUIREMENTS AND CONDITIONS CONCERNING ENTRIES:

- (1) To qualify for Entry in the competition, lighting installations must have been completed on or between January 1,
- 1952 and August 1, 1953.
 (2) To be considered in the competition, each Entry must be submitted by an individual who is either the owner or a fulltime employee of a regularly established
- electrical contracting firm.

 (3) Installation, in order to be eligible for competition, must have been initiated by the electrical contractor or by a full-

- time member of his firm. (Lighting installations initiated by other than electrical contractors or their full-time employees are not eligible for Entry in this competition. However, installations on which the electrical contractor engaged the sales and/or engineering services of electrical distributors, lighting equipment manufacturers, electrical utility companies or others are not disqualified.)
- (4) A participant by submitting an Entry agrees to be bound by all the rules of the contest. No Entry will be returned. Upon submission, each Entry and the contents and ideas therein become the property of Electrical Construction and Maintenance which shall have the exclusive right to make unlimited use, in whole or in part, of the same.

V. AWARDS:

Entries will be judged on the following considerations: Sales effort, practical or aesthetic customers' benefits, effective use of industry aids, lighting adequacy and technical design in engineering features, artistic appearance. Awards in the numbers and amounts as listed below will be made as determined by a Board of Judges.

18 AWARDS

(1) 6 First Awards, each \$100.00 in cash, an

for Electrical Contractors

LIGHTING COMPETITION FOR ELECTRICAL CONTRACTORS

Eighteen Awards

First, Second and Third Awards For Each Of The Following Types Of Lighting Installations completed between January 1, 1952 and August 1, 1953.

- 1. Stores all interior sales areas.
- 2. Schools and Offices classrooms, private and general offices, drafting rooms, etc.
- 3. Industrial factories, warehouses, production and assembly areas, yard lighting, protective lighting, storage areas.
- 4. Residential entire house or any parts thereof, including exterior and garden lighting.
- 5. Floodlighting monumental, recreational, spectacular, and utilitarian.
- 6. Miscellaneous banks, museums, libraries, hospitals, hotels, churches, theaters, retaurants, auditoriums, gynasiums, lobbies, reception rooms, ballrooms, etc.

AWARDS



First Awards — Each \$100.00 in cash, an Award Certificate, publication of winning installation in Electrical Construction and Maintenance, and 500 reprints of published installation for winner's local promotion sales.



Second Awards—Each \$50.00 in cash, an Award Certificate, publication of winning installation in Electrical Construction and Maintenance, and 500 reprints of published installation for winner's local promotion sales.

Third Awards — Each \$25.00 in cash, an Award Certificate, publication of winning installation in Electrical Construction and Maintenance, and 500 reprints of published installation for winner's local sales promotion.

Award Certificate, publication of winning installation in Electrical Construction and Maintenance, and 500 reprints of the published installation.

(2) 6 Second Awards, each \$50,00 in cash, an Award Certificate, publication of winning installation in Electrical Construction and Maintenance, and 500 reprints of the published installation.

(3) 6 Third Awards, each \$25.00 in cash, an

Award Certificate, publication of winning installation in Electrical Construction and Maintenance, and 500 reprints of the published installation.

The selection of Award Winners will be made from all entries. In the event of ties duplicate awards will be made.

VI. ANNOUNCEMENTS OF AWARDS: The names of all Award Winners will be announced as soon as possible after the close of the competition.

VII. The decisions of the Board of Judges with respect to awards and all other competition matters are final and binding on each participant.

VIII. The competition and awards are subject to all applicable local, state, and federal laws and regulations.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

A McGraw-Hill Publication



330 West 42nd Street New York 36, N. Y.



Lighting Competition	on C	hairman
ELECTRICAL CONSTRUCTION	AND	MAINTENANCE
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New York 36, N. Y.		

Dear Sir:

Please send me___official entry forms.

Name

Company

__Title_

Address

City

Zone State

NEW LABELING TAPE

Write on it-Won't Smudge resists dirt, oil, water, acids



For Shop, Factory, Laboratory

Nothing else like LABELON—the amaxing "Write on it" plastic tape! Use it to identify fuel lines, electrical circuits, panelboards, instruments . . to label laboratory equipment, supplies, experiments, models . . . to indicate repairs and service . . . to tag tools, mark bins . . . to label office files, folders, storage cartons, etc.

LABELON TAPE sticks without moistening to any smooth, clean surface yet can be quickly removed. Resists heat up to 160°. Just write on it with pencil or stylus — message won't smudge. Choice of widths and colors. Handy dispenser with cutter bar.

See your nearest dealer, or write for sample and prices.

-LABELON TAPE CO., Inc.-

Dept. EC, 450 Atlantic Ave., Rochester 9, N. Y.



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BALANCED BRIGHTNESS lighting provides a cheerful atmosphere and comfortable seeing for patrons and employees alike in a second floor banking room of the Lincoln First Federal Savings and Loan Association in Spokane, Washington. Recessed prismatic lens troffers combined with cove lighting provides 50 footcandles illumination average throughout the room.

and furniture and furnishings to provide maximum visual comfort throughout the entire interior.

The recessed troffers contain four F96T12 CW fluorescent lamps, operated at 430 ma, above No. 9016 Holophane prismatic glass lens plates. The lenses redirect the light in a controlled pattern and prevent excessive brightness at angles above 45° from the vertical. Fluorescent lamps are run continuous in the two coves, lighting the center ceiling panel

smoothly, reducing the contrast between the lighted troffers and the acoustical ceilings in which they are installed. A light-colored floor also reflects enough light back to the ceiling to light it softly, and aid in keeping brightness contrasts at a minimum. Thus the lighting effect is comfortable for both customers and employees.

The prismatic lens troffers and cove lighting equipment were furnished by Columbia Electric & Manufacturing Co., Spokane, Washington.

Department Store Modernizes With Light

In the modernization plans of Marshall Field and Company, North State Street, Chicago, no single factor received as much consideration as lighting. This was stressed by illuminating engineer Ed Riego and by those in the Building and Maintenance Division

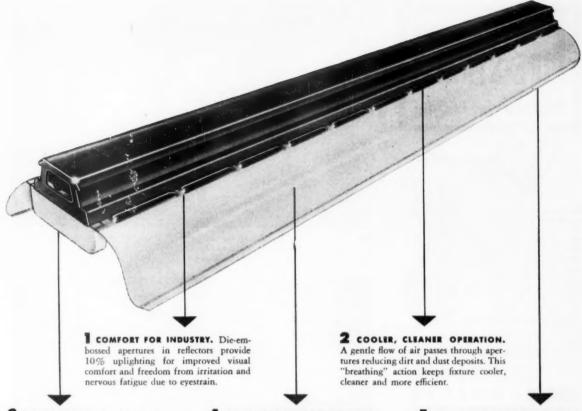
who specified and installed the new illumination equipment.

Consideration of a few specialized sections of the store illustrate the variety of treatments used to produce Light for Selling.

Women's shoes, for example, are



FIG. 1—Cove lighting in women's shoe section produces 24-fc illumination level while recessed incandescents raise levels in front of chairs and divans.



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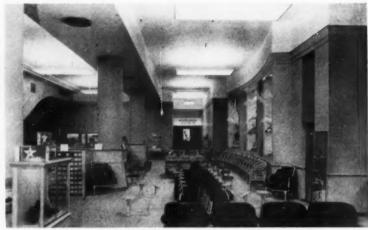


FIG. 2—Louvered panels shield 6- and 8-foot slimlines to produce 35-foot general illumination. Wall niches are top-lighted by incandescent floods, showcases by single 14-watt fluorescents.



FIG. 3—Surface mounted end-to-end fluorescent fixtures have eggcrate bottoms and glass side panels. Light at foot level is 64-fc for comfortable appraisal of shoes.



FIG. 4—Circline lamps around 150-watt projector floods are contained in square louvered panels, inserted along the continuous rows for accent purposes. Footcandle measurements at table height are 73.



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shown in a 2300-sq-ft. area generally lighted by large coves and highlighted in front of seats by recessed 150-watt projector floods (Fig. 1). Coves are bordered by double rows of 3500degree white fluorescents with overlapped terminals, and the general level of illumination from these cove sources is 24.3 footcandles. Decorative mural wall panels are reflected by a floor-to-ceiling mirror on the opposite side of the salon that creates the impression of a room twice as vast as its actual physical dimensions.

Another women's shoe section (Fig. 2) is simply illuminated by suspended louvered grids shielding 6-foot T-8 and 8-foot T-12 slimlines. Average floor-level intensities are 35-fc. Wall niches are highlighted by 15-watt overhead floodlights and showcases are illuminated by 15-watt fluorescents.

Men's shoes and hats (Figs. 3 and 4) are lighted with the same elements. End-to-end fluorescents surface-mounted fixtures with louvered bottoms and glass sides contain 40watt fluorescents while square intermediate units contain 150-watt incandescent projector floods combined with 32-watt circline lamps. Intensity at table height (hat section) measures 73 footcandles while those at foot level (shoe department) are 64-fc.

Office Relighting Saves Money

Proof positive that relighting can save more money than the installation itself cost is clearly presented in the offices of the Investors' Syndicate, Minneapolis, Minn. Here, a new fluorescent lighting installation not only greatly improved the visual environment, but also eliminated the pressing necessity of installing a much larger air conditioning system to handle an excessively heavy heat load due to the old incandescent lighting.

Prior to this new lighting installation, the large office space was lighted to a varying 5 to 18 footcandles by incandescent units. Although this poor lighting was troublesome in itself. a more serious problem arose from the extreme heat which the units developed. The air conditioning system in the office area had become seriously overloaded and was almost useless due to the heat. Faced with the necessity of improving heat dissipation, the owners were advised of a way to "kill two birds with one stone." It was obvious from a survey of the conditions, that there would be no need to install a new air conditioning system if heat could be appreciably reduced by relighting the area. This possibility had the advantage of improving the lighting conditions as well as the heat condition. And there would be a substantial saving in cost.

The new lighting system was installed by the Sterling Construction Co., Minneapolis, 1t consisted of 980 four-foot T-12 medium bi-pin Mitchell units, taking two 40-watt lamps each. The all-metal fluorescent fixtures were mounted in continuous rows on 36inch stems. With this new system, an average 55-footcandle level of comfortable lighting today prevails throughout the area.



RELIGHTING INSTALLATION in this expansive office area improved poor visual conditions; saved the cost of installing a new, larger air conditioning plant.





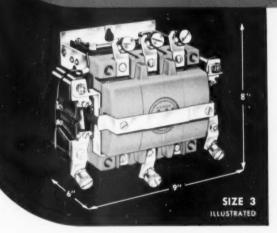


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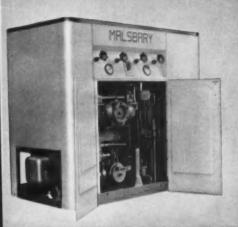
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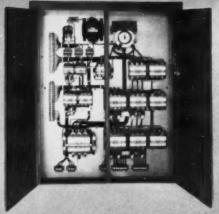
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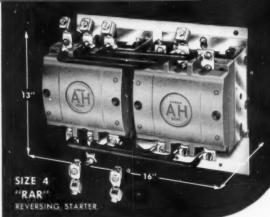
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DELUXE SERVICE TO A TRAILER PARK [FROM PAGE 95]

A total of six transformers, spotted at load concentrations throughout the trailer park area, are fed by the 3-phase, 4-wire, underground primary loop. All but one of these units is a 50-kva, 2170/115/230-volt, singlephase, dry type transformer which feeds a block of 60 to 70 trailers. The exception is the 371-kva unit serving the utility building and a smaller group of trailers.

Each transformer is mounted on a heavy concrete pad and enclosed in a weatherproof metal cabinet; is connected to one phase and the neutral of the primary loop. By means of a flexible method of primary connections (Fig. 2) the loop can be opened at each transformer enclosure to isolate a portion of the feeder cable. No transformer need be out of service due to a feeder failure. To accomplish this, three cutouts (two unfused and one fused) are installed in the phase lead to each transformer. A jumper between the "load" sides of the unfused cutouts is connected to the fused cutout protecting the transformer. The other primary transformer lead is connected direct to the neutral cable. To isolate a desired section of feeder, either of the unfused cutouts can be opened. If both units are opened and the fuse (in fused cutout) removed, the transformer can be isolated when necessary.

The transformer primary neutral leg, transformer case, metal enclosure and feeder neutral are all connected to a driven ground rod at each transformer mat.

Secondary Distribution

Underground secondary distribution is 110/220-volt, single-phase, threewire. On the exterior of each transformer enclosure are two 200-ampere. 220-volt, fused, weatherproof disconnect switches. Each takes care of one-half block of trailers (about 30) to 35 units). From each switch, a 3-conductor, No. 3/0, direct-burial cable with moistureproof jacket goes underground (40 inches below grade) to feed a line of eight to twelve "meter posts." Each post serves from two to four trailers.

A typical meter post consists of a creosoted 6-in. by 6-in, wood post extending about five feet above ground level. On it are mounted a weatherproof cabinet housing the secondary feeder connections, and plug fuse block for the trailers; four weatherproof, 30-ampere, 2-pole (with grounded shell), current rupturing receptacles; and four socket-type watthour meters. On posts which also support a floodlight standard, the cabinet houses a time switch to operate the lights. Each post is grounded by a 15-foot length of No. 8 bare conductor bonded to the cabinet and buried in the feeder-cable

Underground connection between the meter-post receptacles and each trailer is made with a length of 3-conductor, No. 12, Type RR cable. Two conductors provide the electric service; the third bonds the trailer frame to the ground system through the plug and receptacle shell. This is the only part of the entire electrical system that might be considered "portable." The plug and cable connection is removed and the receptacle capped when a tenant moves. A park maintenance electrician makes the cable connection when a new tenant arives. Major maintenance of the distribution system is handled by Goldberg & O'Brien Company.

Operating experience with the electrical distribution system has been exceptionally good, according to park manager S. L. Blomgren who is pleased with the flexibility of the design. Periodic spot meter readings taken at various trailers indicate that no low voltage exists even at remote points. Management now has what it wanted: a flexible distribution system that provides safe, reliable electric service to the hundreds of trailer occupants. And the engineering design of the system allows for future load growth at the park.



CHECKING OVER an estimate and takeoff on an electrical construction project are B. B. Franklin, partner, and W. E. Trombley, estimator, at Lansing Electric Motors, Lansing, Michigan. Franklin together with Lynn Kestenholtz supervise the company's construction department.

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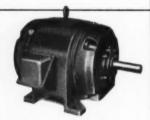
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Motor Shops



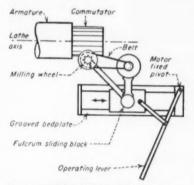
WITH MILLING WHEEL (a) at the side of the commutator, operator can remain seated with eye level with cutter and, since movement of operating lever (b) requires no visual attention, entire concentration of operator can be on cut.

Electric Undercutter Is Fast and Accurate

Fast, accurate undercutting of commutator mica is accomplished in the repair division of the Warwood Armature Repair Company, Wheeling, W. Va., by means of a motorized milling device designed and constructed in their shop. The milling wheel revolves on a vertical shaft which is fastened to a fulcrum bar by means of a swing coupling. In this manner the milling wheel can be moved towards or away from the axis of a bench lathe and, through this adjustment, the operator can accurately regulate the depth of cut required to recondition the commutator of any armature supported by the lathe.

The fulcrum spindle, likewise vertically placed, is supported by a sliding block which moves back and forth parallel to the lathe axis in a grooved bedplate which can be bolted to or removed from the lathe frame as desired. The sliding block is moved back and forth by means of an operating lever, the fixed pivot for which is located on the grooved bedplate. Operating arm and sliding block are linked through a connecting rod as shown. Power for the cutting wheel is furnished by a vertically-mounted motor, the shaft of which is parallel to the shaft of the milling wheel. The two shafts are connected through a belt and pulleys.

Since the milling wheel is on the side of the armature rather than above



PLAN SKETCH INDICATES that movement of operating lever moves sliding block along grooved bedplate. Supporting arm of milling wheel can be moved towards or away from lathe axis, permitting accurate adjustment of undercutting depth.

it as is usually the case, the operator can remain seated while operating the device. This brings the eye level of the operator on line with the milling wheel and he or she can accurately check the cut as it is made. Also, since the operator can move the device back and forth without having to take his eyes from the cutting area, there is no reason for divided attention.

By selecting a milling wheel with the desired thickness, all sizes of commutators can be undercut without the necessity of duplicate operations. Safety for the operator may be obtained by using either protective goggles or positioning a glass shield in front of the milling area.

Roller Compresses Wooden Slot Fillers

In rewinding motors with Formvar wire rather than cotton-enamel stock, it is necessary to fill the slot cavities with narrow maple strips. These strips are cut by a band saw in the shop of the Charleston Electric Supply Company, Charleston, W. Va.; being cut to approximate dimensions during slack periods and conveniently stored in a series of bins beneath one of the wall-located work benches. Cutting the strips in this manner utilizes lull periods to good advantage, but upon installation of the strips into the slots, many of them are found to be slightly oversized, tending to cramp or bind the coils sharing the slots with them.

Rather than re-cutting, planing or sanding these strips to exact dimensions, the wood can be reduced in cross-section area quickly and easily by running them through a small rolling mill. In this mill, the lower steel roller is permanently positioned and turned by a hand crank. The upper roller is supported by pillow blocks which are forced downwards through the action of thumb bolts, and held up against the bolts by means of small coiled springs. Adjustment of the bolts regulates the thickness of the rolled maple strips, while the strips are prevented from shifting by means of a horizontally-adjusted channel.

Rolling the wooden strips saves considerable time and effort and results in a uniform wedge.



MINIATURE ROLLING MILL compresses maple slot wedges to accurate thickness. Machine is hand operated by crank and tension is adjusted by thumbscrewed bolts which exert pressure on upper roller blocks.



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4541 Hamilton Ave COLUMBIA ELECTRIC MFG. CO. Cleveland 14. Ohio



RETURNING SHORT LENGTHS of unused tubing, slot insulation and sticks to this storage bin, and using the shortest lengths possible for all jobs, has effected considerable savings in motor-repair materials used by Charles Buckley in his Atlantic City, N. J., shop.

Storage Bin **Cuts Waste**

Top sticks, tubing, slot insulation and related materials are stored in an 8-shelf rack in the motor repair shop of Charles Buckley, Atlantic City, N. J. Measuring 4 feet high and 3 feet square, this wooden storage bin is marked in white to clearly indicate divisions and designations. The rack is located centrally, yet may be easily moved on its caster base if a shift of location is required.

When shopmen need the various materials, they can quickly select the desired item. Then, when they have finished the job-in-hand, all unused material-including short lengths of cut stock-are returned to the bins. By selecting and using the shortest lengths possible, waste is kept at a minimum.

Before the rack was constructed, employees had a natural tendency to use new sections whenever they needed that type of material. Short sections and unused strips lay around the shop unnoticed and unused. Some of it was swept up and discarded. Waste was considerable. By having a central storage bin where unused material is now returned to, savings have been encouraging.

Armature Index File Saves Time

A roller type of index file has proven to be a worthy asset to the motor repair shop firm of Albertson & Son, Philadelphia, as it helps to give complete armature repair data to shop emplovees at a flip of the cards.

This system is called the Rollerdex file, and it contains a file of 3-in, by 5-in. cards. The cards have been specially printed by Al Albertson so that they give complete armature data on almost every type of armature that this firm rewinds or repairs.

These cards list the manufacturer, factory number of the armature, the manufacturer's number and a complete data breakdown as shown on the card.

"When armatures come to us for rewinding, instead of having to record the complete data of the armature so that we can re-assemble it the same way as it came in, we look up this particular type armature on our cards. As soon as we have the card that corresponds with the particular armature, we take the number that we have placed on this data card and place it on the tag attached to the armature and to our work orders. Then whenever reference has to be made pertaining to the working operations and re-assembly of this armature, our employees just note the number on the tag and refer to our Rollerdex file. Here they find the card and they can get all the information off of it. says Al Albertson.

Cards are filed alphabetically according to the name of the manufacturer. By filing cards every time an armature comes in that are not already in, the firm has developed almost



ROLLER INDEX FILE, used to record complete armature repair data on 3x5 cards on every armature repaired, is checked by Al Albertson of Albertson & Son, Philadelphia. This file provides complete data, readily available, for every armature rewinding job that comes in.

	MAKE	No.
PART NO.	VOLTS	PRICE
MFG.	SLOTS	
MFG NO.	DARS	
MODEL	WIRE	REMARKS
TYPE	DATA	
SIZE	FAN	
CAT. NO.	SIZE	11
LIST		1
TOOL		11

REWIND DATA as shown on this card is maintained for every armature worked on.



Do you have a heating problem in your plant or office . . . any hard-to-heat area? Electromode heaters are your logical answer.

Here's why . . . Electromode heaters are available in all sizes and capacities from 1500 to 45,000 watts to fit any heating problem. They can be located anywhere that electrical wiring can be strung. Equipped with automatic temperature controls and built-in safety switch, means economy of operation and absolute safety from fire, shock, or burn. The exclusive patented cast-aluminum heating elements will not rust or corrode. Electromodes provide an abundance of fan-circulated heat when and where it is needed. Approved by Underwriters' Laboratories and thousands of commercial and industrial plants throughout the country.

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The only Electric Explosion-Proof Heater of its kind approved by Underwriters' Laboratories. Features Electromode patented castaluminum heating element. Specially designed for installation in hazardous areas where heat is required and danger of explosion exists. Available in 2000, 4000, 6000 watt capacities. For full particulars mail coupon below.



Model CX-2 Convection type 2000 watts 240/480 volts.

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a complete file of every type of armature that they rewind. Thus these cards save the time necessary to record information when armatures come in for rewinding, as the data needed by employees can be quickly found on the specific data card.

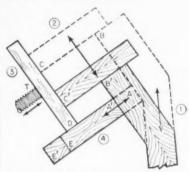
Square Coils Squeezed With Two-Way Pressure

A shop-designed foot-operated press is used to compress rectangular coils in the repair department of the Charleston (W. Va.) Electric Supply Company, where force is applied in two directions simultaneously to reduce the cross section area of the pressure parallelogram.

The principle of operation is schematically illustrated in the accompanying sketch, where steel sides 1, 2, 3 and 4 can be shifted to increase or decrease the distance between the faces of the enclosed area. With plate 3 adjusted



SHOPMADE PRESS is operated through foot action, compressing rectangular coils into compact, uniform cross sections prior to their insertion into motor slots.



BASIC THEORY is that, as side 1 moves down, side 4 is forced back, and side 2 moves down and inward, enclosed area A, B, C, D becomes A', B', C', D. Side 3 is initially fixed through action of thumbscrew T.

by means of turnscrew T, then left in that position during the operation, the area is altered by moving the other three plates. As shown by the arrows, side I moves up and down. As it moves down, position B moves to B'. It also forces side 4 backwards so that point A moves to A'. Side 2 simultaneously moves downward on an angle so that point C moves to C'. The result is that initial area A, B, C, D becomes A', B', C', D. Since retraction of side 2 actually leaves an opening between sides 2 and 3, it is a simple matter to insert or remove the coils with each operation.

Special Work Table Aids Babbitt Pouring

Two gas-fired burners, a sheet metal work table and an exhaust hood are combined to facilitate the rebabbitting of bearings in the shop of H. N. Crowder Jr. Company, Allentown, Pa.

The table, with two 8-inch round holes cut to receive the babbitt ladles, is constructed of \(\frac{1}{2}\)-inch steel. It measures 30 inches on a side and is supported 18 inches above the floor by pipe legs. When bearings are to be rebabbitted, they are placed on this steel table adjacent to the ladle holes and, when the metal is in a molten form, the ladles are merely raised from their positions above the gas burner units and tipped for pouring.

Above the table is a sheet metal hood for the collection of fumes which are exhausted into a stack through the action of a ½-hp motor-driven fan, as-

suming safe operation.



LADLE IS LIFTED from gas-fired burner and is tilted into a bearing which rests on sheet steel table. Exhaust hood and fan remove fumes and heat.



"We save an average of one man-hour per day with our Service-Master Body — because we no longer have to make frequent returns to the shop for parts that couldn't be carried on the first trip. With today's high labor costs, one man-hour daily means a big saving in a year's time. More than enough to buy another Service-Master."

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- 1. Removable overhead rack.
- Telescopic roof and endgate enclosure.
 Removable vise bracket
- with pipe support.

 4. Rear bumper with safety.
- 4. Rear bumper with safetytread step.
- Side-mounted pipe carrying brackets.

Look at all the features you get in a POWERS Service-Master:

Fully enclosed wheelhousings protect underside of compartments and strengthen side panels; one-piece, ribbed-steel floor distributes weight evenly and prevents sagging at any point; all-steel body shell is electrically welded to form one complete unit; can be mounted on new or used chassis and easily transferred from one unit to another.

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As if by magic, an aluminum alloy tower of any height desired is ready in minutes! Individual scaffold sections are set one on top of the other. Sections lock into place instantly.

HERE'S THE SECRET!...

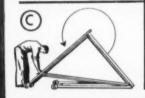
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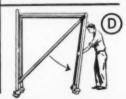
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Each one-piece section is unfolded by one man in less than a minute! No tools, wing nuts or bolts.









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In The News

Construction Controls Eased

. The National Production Authority made its most significant relaxation of construction controls early in December, when it lifted the ban on recreational, entertainment and commercial building, effective January 1 of this year. This action was taken through the issuance of Revised CMP Reg. 6, Direction 8 as Amended, December 10, 1952. New construction activity has not been permitted for such structures since October 26, 1950, when the ban was put into effect to conserve structural steel, copper, aluminum and other types of building materials needed for industrial expansion and other defense construction.

In lifting its ban on recreational and entertainment construction—such as theatres, country clubs, swimming pools, amusement parks, etc—NPA also said builders of commercial projects, schools, hospitals, public works and other types of projects will be allowed substantial extra amounts of materials. These increased allotments are now provided for through a self authorization procedure, within

specified limits.

It was originally planned to ease restrictions on entertainment and amusement construction projects May 1, this year. But in line with the recommendations and request of a special task group of the Building Construction Industry Advisory Committee, which claimed easing of controls would not require substantial amounts of materials, NPA made the change effective beginning January 1 instead. The revised NPA regulation now

The revised NPA regulation now permits builders of these types of projects to write their own priority tickets for certain limited amounts of materials. They may self-authorize their orders for up to five tons of carbon steel, including not more than two tons of structural shapes, and up to 500 pounds of copper for each such project in any quarter.

Effective May 1, 1953 builders will also be permitted to self-authorize for up to 300 pounds of aluminum for these types of projects. Relaxation planned for use of aluminum by builders was not advanced to January 1 because of the aluminum shortage resulting from the cutback in electric power in the Pacific Northwest and in the Tennessee Valley during the last quarter of 1952, due to water short-

THRESHOLD OF A NEW ERA

A Comment on the Year Ahead

by D. B. Clayton, Sr.

Birmingham, Alabama
President of the National Electrical Contractors Association, Inc.

We are crossing the threshold of not only another new year but, indeed, of a new era. We have ordered a change to take place in the conduct of our political affairs and what is now commencing to take place will in time profoundly affect the economic and social structure of the country. We hope that it will be for the best. We look forward to it with great confidence.

There is every indication that a record construction year awaits us in 1953 and since the application of electricity is increasing phenomenally, we are assured of a very large volume of business to transact. Insofar as our business is concerned the boom appears to be rather firmly underwritten for well into 1953 at least and the tempo of electric utility expansion seems to give us adequate assurance that business will be good for many months to come. We anticipate that electrical contractors will be performing well over \$2 billion in business during 1953. There is almost that much again of business that beckons to them.

In fact, the big problem confronting our industry involves the prime management responsibility of making ready our industry and maintaining its readiness to do the increasingly big job expected of it. We have the problem of developing business through constructive sales effort to take the costly and enervating peaks and valleys out of our business; of improving their business and technical methods; of increasing the number of and improving the skills of our mechanics; and of correcting certain basic evils in the industry.

Our industry has taken positive steps to be ever ready and able. The National Electrical Contractors Association enters the new year with militant and comprehensive programs involving business development, research and education, legislation, apprenticeship and training and sound labor relations.

Builders of small apartment houses are also now permitted for the first time by NPA under present controls to self-authorize their own orders for materials. For walk-up apartment houses, builders are now allowed materials for each dwelling unit as follows: Two tons of carbon steel, including not more than 500 pounds of structural shapes; and 200 pounds of copper. Beginning May 1, they will also be allowed 275 pounds of aluminum.

Restrictions on the use of structural steel in homes have also been dropped. Builders may now use up to 1500 pounds of structural steel in the construction of one-family through four-family homes. Materials for commercial projects such as stores, garages, and office buildings, as well as schools, hospitals and public works may now be self-authorized for sub-

stantially increased amounts by builders. Quantities conform to the self-authorization allowance granted builders of industrial projects, as follows: 25 tons of carbon and alloy steel, including structurals; 5000 pounds of copper; and 2000 pounds of aluminum. After May 1 this year they will be allowed 4000 pounds of aluminum per project.

Construction of amusement and entertainment projects, prohibited for more than two years, may total over \$250 million in 1953, according to John L. Haynes, Director of the Building Materials Division of NPA. These projects will, however, all be small. The building materials requirements for this construction can be met without interfering with supplies for the \$33.3 billion of other types of construction activity estimated for 1953, Mr. Haynes pointed out.



ENTHUSIASTIC proponent of modern motor repair shop methods is Ross E. Waite, president, Monarch Electric & Supply Co., LaSalle, Illinois. Ross is secretary of the Illinois Valley Chapter, Illinois Society of Professional Engineers; grew beard to celebrate the City Centennial.

NISA News

The New England Chapter held its regular meeting on November 13, at the Hotel Bradford. The business meeting was called to order by President Harry Bedig. The secretary's report was read and accepted and also the treasurer's report. The program committee reported that the next meeting would have Joe Noonan of the Smaller Business Bureau for a guest speaker.

Ed Kolhonen, program chairman introduced the guest speaker of the evening, Mr. George McIntyre of the Dow Corning Corp., who gave an interesting talk on the advantages of silicone insulation.

New York Metropolitan chapter held its first "Ladies Night" meeting at Hotel Statler on November 20. Very large attendance evidenced great appeal of this event. Beautiful orchid corsages were presented to the ladies by Joe Brown of Brownell Distributors. After dinner and a brief business session, Milt Volcker showed colored pictures of his recent trip to the Near East and Southern Europe.

Another "Ladies Night" was held across the nation in Los Angeles, California. Highlight of the event was presentation of a few short films by John Steckel of Mutual Insurance Company.

Expansion of NISA shops is evidenced by Dowzer Electric Machinery Works, Inc., Mount Vernon, Ill., which is erecting an addition to its transformer shop for the stripping and refinishing of transformer cores. What's more they have the footings poured for another building and sufficient ground for further growth.

Electric Motor & Repair in Raleigh, N. C., is adding a 6,000-sq. ft. section to its transformer shop.

Swanson-Nunn Electric Co., Evansville, Ind., is adding 10,000 sq. ft. to its present 31,000.

The NISA Board of Directors met Nov. 8-10 for their semi-annual meeting at the Hotel Sheraton in St. Louis.

All but one of the Association's 18 directors were present during the three-day Session.



USE THE PROPER METHOD to make aluminum connections and there should be no trouble on aluminum conductor systems, states Richard C. Martin, electrical engineer at ALCOA's Davenport plant. Dick speaks from years of experience on ALCOA's all-aluminum distribution system; teaches plant electrical maintenance apprentices in addition to his plant engineering duties.

William J. Wheeler, New York, and John E. Launder, Kansas City, attended the meeting as guests of the Board, so they could present their reports as chairmen of their committees. All other committee chairmen are directors.

President R. A. (Rudy) Scherer, Indianapolis, presided at all of the meetings which included nine-to-fivethirty sessions on Saturday and Sunday, and a nine-to-noon meeting Monday morning.

Reports were made by all officers and committee chairmen.

Important action taken by the Board of Directors included selection of Los Angeles as the 1955 convention site. (The 1954 convention is scheduled for Detroit.)

A national publicity program, aimed at bringing the name of NISA be-

fore more persons in industry as well as before the general public, was approved by the Board of Directors. The program, which will be operated from National Headquarters, will be conducted by Horace Barks, managing editor, NISA NEWS, who has been appointed publicity advisor to NISA.

Award committee headed by T. M. Russell, chairman, reports that this year 14 awards will be given, amounting to \$350. The committee also reminds membership that some ideas which seem quite simple to originators may be the ones of interest and value to other members.

The annual Southeastern Chapter convention in Miami Beach, Fla., Oct. 16-19, was a three day affair that saw a total of 227 registered.

A lot of the credit should go to Ed Grant and his publicity committee for helping to arouse the interest in this meeting. Many others helped, too.

The entire meeting was a pleasant combination of business and pleasure just about the right amount of each. On the serious side, there were papers delivered by Guy M. Perry, branch manager, Skil Corp., Miami, Fla., on the subject of high speed portable electrical tools; by F. E. Cook, assistant manager, Augusta, Ga., plant, The Electrical Equipment Co., Raleigh, N. C. on the subject of new shop layout; by E. F. Treiwe, Norwood Plant, Allis Chalmers Co. on his company's certified shop plan; by J. Arthur Turner Jr., Tampa Armature Works, Inc., Tampa, Fla.; on sales promo-



MOTOR REPAIR activities of Lansing Electric Motors, Lansing, Mich., are under the direction of Fred Selby, whose experience and know-how produce many time-saving ideas in the shop.

tion; by John W. Overton, Electric Motor & Repair Co., Richmond, Va., on sales management; and by R. H. DeLoache, manager of sales and service, Cleveland Electric Co., Atlanta, on pricing procedure.

An interesting tour of the Eastern Air Lines maintenance shops-which employ 10,000 men-was one of the

highlights of the meeting. Fred B. Wipperman, NISA Executive Secretary, conducted a brief forum on NISA NEWS, to determine what kind of material the members want in their Association magazine.

"brass" present-including The Oscar Clot, our retiring chapter president, Fred Wipperman and Rudy Scherer-received official keys to the city by an official of Miami Beach.

Walter J. Prise, The Maintenance Co., New York, and Frank W. Sloan, who operates his business under his own name in San Diego, have been added to the Publication and Publicity Committee by Chairman Alfred Elson Ir.

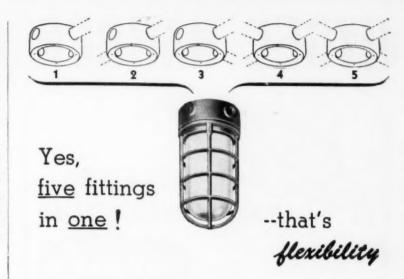
Other members of the committee are H. Ed. Grant and Charles C. French.

Thirty-Four members were present at the fall meeting, Sept. 7, of the North Central Chapter, held at Minneapolis' Sheridan Hotel. The group included nine visitors from Iowa. All told, 62 members and guests were on hand to attend "Call Me Madam" as guests of the H. A. Holden Co., Minneapolis.

Earlier in the day the chapter met for lunch, then toured two of Minneapolis' electric machinery plants. During the meeting, E. N. Olson, Olson Electric Works, Minot, N. D., showed members drawings of a patent for a multi-speed induction motor, designed by his shop superintendent, Peter Ziegler. Fred Gudgen gave a talk on "Credits and Collections," and George Svendsen spoke on designing control for slip ring motors. Regional Director Frank Ross talked to the members about NISA services and materials.

San Diego Chapter met for dinner Oct. 20 at its regular meeting place, Langhorst's Cafe. Following the dinner, the group discussed the electric motor winding contest, conducted annully in the area by the San Diego Electric Club. Several San Diego NISA members are sponsoring high school students in the contest. The chapter also discussed the problem of improving the electric motor and re-

pair class in the local vocational school. Color movies were shown by



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November 12 was a happy day for members of the Quaker City Chapter. Bill Hendrickson of William Hendrickson & Co., Philadelphia, whose shop was severely damaged by fire, was host at an open house held during the late afternoon, in celebration of his complete business recovery. After leaving the Hendrickson shop, the chapter watched tests on a Henry converter at Howard Davies, Inc., then adjourned for dinner at Beck's-On-The-Boulevard. Following dinner there was a reception for NISA President R. A. Scherer.

More then seventy-five NISA members attended the meeting, among whom were the following visitors from New York: Walter Prise, Maintenance Co.; Milton Benjamin, Empire Elec. Co.; Fred Schneider, Schneider Elec. Motor Co.; Meyer Friedkin, Elec. Enterprise Co. Also Rolland Stolzenbach, Rolland Elec. Co., Baltimore, Md.

The Hotel London, London, Ont., was the location for the Ontario Chapter's Sept. 13 meeting, which began at 10:30 a.m. with 16 representatives of 12 member shops present. The chapter is taking steps to provide NISA NEWS with material about Canadian shops. The group is also interested in the Canadian government apprenticeship training program for motor shop employees and has invited a government official to discuss the problem at the next meeting. Members decided to invite their foremen to the next session.

. . . .

The Niagara Chapter held a meeting on November 14 at the Rochester Club, Rochester, N. Y. Host was Ray Hornbeck, of the T. H. Green Electric Co., Inc., Rochester. Refreshments, dinner, and business meeting were followed by a talk by Rudy Scherer, national president. He presented slides showing cleanliness in repair shop operations; this is something which most shops feel is too expensive to be justified. However, many of our members began to feel in doubt, when they found out that in spite of extreme cleanliness, he has moved to larger shops three times in the past 25 years.

After the meeting, Bob Schwarz of the O. G. Schwarz Co., 432 Atlantic Ave., Rochester was signed up.

From Walter J. Prise, The Maintenance Co., New York, N. Y.

DATES AHEAD

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 19-23.

Plant Maintenance Show—Public Auditorium, Cleveland, Ohio, January 19-22.

Electrical Industry Convention—Nicollet Hotel, Minneapolis, Minn., March 8-11.

National Electrical Manufacturers
Assn.—Edgewater Beach Hotel, Chicago, Ill., March 9-12.

Industrial Electrical Exposition—Sponsored by Essex Electrical League, Terrace Room, Newark, N. J., March 10-13.

Edison Electric Institute—Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 30-April 2.

Chicago Electrical Industry Show— Sponsored by the Electric Association and the Electrical Maintenance Engineers of Chicago, Conrad Hilton Hotel, Chicago, May 11-14.

National Fire Protection Association— Edgewater Beach Hotel. Chicago, Ill., May 11-15

National Industrial Service Association
—Annual convention, Hotel Statler,
New York City, May 24-28.

National Association of Electrical Distributors—45th annual convention, Conrad Hilton Hotel, Chicago, Ill., May 24-28.

Edison Electric Institute—21st annual convention, Atlantic City, N. J., June 1-4.

American Institute of Electrical Engineers—Summer general meeting, Atlantic City, N. J., June 29-July 3.

Hotel Commodore, New York, N. Y., September 14-18,

International Association of Electrical Inspectors—25th Jubilee meeting, Edgewater Beach Hotel, Chicago, Ill., September 21-26.

Industrial Electric Exposition—Hotel William Penn, Pittsburgh, Pa., October 6-8.

Canadian Electrical Manufacturers
Assn. — Annual meeting, General
Brock Hotel, Niagara Falls, Ontario,
Canada, September 23-25.

National Electrical Manufacturers
Assn.—Haddon Hall Hotel, Atlantic
City, N. J., November 9-12.

Book Reviews

Standard Practice for Industrial Lighting

A new and revised edition of American Standard Practice for Industrial Lighting has recently received full approval of the American Standards Association, and is being published in a 40-page booklet by the sponsor, the Illuminating Engineering Society. Completely revising the first recommended practice on this vital lighting-subject published ten years ago, the

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In addition to the large stock of motor and control renewal parts for which we are widely known, we also carry a complete line of supplies for motor re-winders.

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new standard is designed to meet today's superior lighting requirements and covers many specific lighting problems not included in the 1942 report. Since then studies and reports have covered lighting for woolen and worsted mills; canneries; commercial bakeries: inspection lighting problems such as supplementary lighting and lighting for machining small metal parts; and other industrial lighting

The new Standard Practice analyzes the factors affecting industrial seeing tasks and the elements of good illumination required to perform those tasks. A wide variety of these tasks within specific manufacturing categories from "airplanes" through "woodworking" are listed alphabetically in convenient tables giving required footcandles for Necessary quantities of illumination; qualities of light sources; distribution and diffusion; brightness ratios and reflectance values of surrounding areas; are also explained and recommended. One table, Classification of Visual Tasks and Lighting Techniques, lists many general characteristics of industrial tasks and recommends lighting techniques for each.

7

Daylighting and its proper control, and artificial light and lighting systems are explained in detail and methods and recommendations suggested. Programs for maintenance and cleaning of lighting fixture and room surfaces are also included in the new Standard Practice. Appendices deal with advantages of good illumination, brightness and brightness ratios, adequate electrical wiring, and light sources. The booklet is fully indexed and illustrated.

This new Standard Practice was prepared by the Committee on Industrial Lighting of the Illuminating En-1860 Broadway, gineering Society. New York, 23, N. Y. Price is \$0.50



NECA MEMBER Joseph O. Haskins, visited on one of his busy days, was filmed in a characteristic pose—on the phone. This Huntington, W. Va., contractor is an authority on estimating procedures.



TOO MANY contractors let the public sell them down the river on cheap wiring, C. R. Robbins, Moline, Ill., electrical contractor tells inspector group. Robbins has been in the electrical construction industry almost 40 years.

Among the Manufacturers

Headquarters Announcements

Allis-Chalmers, Milwaukee, Wis.— Robert L. Baseley, substation sales section; David Sleeman, control sales section.

BullDog Electric Products Co., Detroit, Mich.—Murray C. Nelson, associates' regional manager; Howard D. Ogden, administrative assistant to the sales manager.

Cutler-Hammer Inc., Milwaukee, Wis.—F. J. Meyer, division manager for heating device sales; R. R. Smith, division manager for renewal parts

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.—Paul B. Wishart, general manager.

The Baker-Raulang Co., Cleveland, Ohio.—E. E. McVeigh, manager of commercial sales.

Rodale Mfg. Co., Inc., Emmaus, Pa.—Jack J. Kushner, sales executive in charge of the export division.

Gruber Lighting, Brooklyn, N. Y.
—Herbert Mould, director of sales promotion.

General Electric Company, Schenectady, N. Y.—Frederic H. Holt, manager of marketing, and James W. Cooke, manager of engineering, both for the control department.

Berko Electric Mfg. Corp., Queens Village, N. Y.—Stanley Aaronson, sales manager for electric radiant heating panel.

Everson Electric Co., Allentown, Pa.—Fred L. Keller, vice president.

H. K. Porter Company, Inc., Pittsburgh, Pa.—C. S. Beattie and R. E. Anderson, vice presidents directing the Delta-Star Electric Division, formerly the Delta-Star Electric Company.

Sylvania Electric Products Inc., New York, N. Y.—Raymond K. Mc-

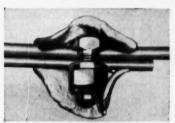
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Write for Catalog 38-A



Clintock, manager of new product promotion.

The Orangeburg Mfg. Co., Inc., Orangeburg, N. Y .- announces construction of a new \$2\frac{1}{2}-million plant in Newark, Alameda County, Calif.

Regional Appointment **NEW ENGLAND**

Wagner Electric Corp.: John T. Kemper, manager of the Boston, Mass., electrical division office.

MIDDLE ATLANTIC

Day-Brite Lighting, Inc.: John W. Hamilton, architectural representative in New York City.

Unistrut Products Co.: Sherman White, Irvington, N. J., sales repre-

Columbia Cable & Electric Corp.: Burton Cooper, Morton Weiss, Jack Goldstein and John Barker, sales representatives for Metropolitan New York; Herbert C. Leonard, Thornwood, N. Y., sales representative.

Baker-Raulang Company: Edmund C. Horman, regional sales manager for Metropolitan New York.

SOUTH ATLANTIC

General Electric Company: J. A. Stollman, Construction Materials' district representative in Jacksonville, Florida, area.

Unistrut Products Company T. G. Greene. Atlanta, Ga., sales representative.

EAST CENTRAL

Anaconda Wire & Cable Co.: Ross A. De Matteo, sales representative in the Detroit, Mich., office.

Allis-Chalmers: Fred C. Timberman, manager of the general machinery division's new Akron, Ohio, branch office

Unistrut Products Company: Albert E. Serewicz, Chicago, Ill., sales representative; George T. McKay, Cleveland, Ohio, sales representative.

BullDog Electric Products Co.; Richard P. Beaubien, field engineer in the Detroit, Mich., office; David W. Frazier, assistant to the district manager of the Cleveland, Ohio, district.

WEST CENTRAL

Columbia Cable & Electric Corp.: R. E. Dunn Sales Co., Minneapolis, Minn., sales representative.

WEST

Unistrut Products Company: Keith H. Long, San Francisco, Calif., sales representative.

Columbia Cable & Electric Corp.: The Sanderlin Co., Seattle, Wash., and Portland, Ore., sales representative.

LIGHTING MAINTENANCE

FROM PAGE 881

selling points. And the contractor will get more overall work because his customers will call on him as a matter of course.

The established electrical contractor already has his regular sales force, customer confidence and the most knowledge of his customers' lighting installations. He merely needs to point out what he is offering in the way of lighting maintenance service. Once the customer is sold on planned lighting maintenance service, he can be eliminated from the advertising mailing list—if the contractor remembers that good service sells itself.

Lighting maintenance service truly is a part of the service that the electrical contractor interested in lighting jobs should offer his customers. For the good of the industry contractors should realize the possibilities, if only so that the growing demand for better lighting will not be dampened by good jobs gone sour for lack of maintenance. Every good job is a potential salesman, whether for more lighting jobs or just lamp sales.

And that brings to mind a relationship many contractors may not have thought about. I didn't until quite recently. I have pointed out that lighting maintenance service logically fills in the electrical contractor's job and profit potentials.

For me, in the lighting maintenance business only, I have found that lamp selling plays the same part. In fact, recently I went out to sell Deluxe white lamps to florists and others who could really benefit greatly by their use. In three calls \$519 worth of lamps were sold to three customers along with three maintenance contracts.

I know selling lamps does for me what selling lighting maintenance will do for contractors—so selling lamps also shouldn't be overlooked. Then they will have two profit-getting, and two job-getting aids working to raise their profit curve.

Plan for Renting Light

In these days of expansion and remodeling, high labor costs and higher capital investment taxes, the question of what kind of a lighting system to install has plagued many businessmen. Why hasn't it been possible to rent light (lumens), just as it is possible to rent a car, or a building? Until recently no one had an answer to this question. Now light can be rented.

(Continued on page 216)

WHATEVER YOU CALL AN INSULATION TESTER

THE

MODEL B-7 MEGOHMER

IS TOPS

COMBINED PRECISION OHMMETER & MEGOHMMETER 0-20, 0-200 MEGOHMS. 0-200, 0-20,000 OHMS.

Reads as low as 1/10 of 1 Ohm to as high as 200 Megohms. 2 Test Potentials 250/500 Volts. No cranking, no wavering of pointer. Saves time and effort. Simplifies Insulation Testing. Ideal for low resistance testing too.

WRITE FOR NEW BULLETIN 440

HERMAN H. Stick COMPANY, INC.





YOU CAN SELL MORE PROFITABLE LIGHTING

with the 16 page reprint of

ELECTRICAL CONSTRUCTION AND MAINTENANCE'S

OCTOBER LIGHTING ISSUE

Now Available at 25c Per Copy

In response to requests from all over the country, the editors are offering reprints of the provocative October lighting editorial section—Light . . . Challenge of the Fifties—as long as the supply holds out.

Complete, and in color, this reprint contains important lighting market outlook charts ... the 7 step program for increasing lighting sales ... the 10 step outline for selling each new lighting prospect ... plus a capsule presentation of new trends in lighting. Here is a plan for building business in the months ahead ... a specific plan tied to lighting and based on successful experience ... that every contractor can apply to every customer and every lighting job—new construction or modernization.

ORDER TODAY! The limited supply won't last long. Use the convenient coupon. Make sure you order sufficient copies.

ELECTRICAL CONSTRUCTION AND MAINTENANCE 330 West 42nd St., New York 36, N. Y.

Please rush to me.........copies of the October Lighting Issue reprint at 25¢ per copy (less than 100 copies), or 20¢ per copy (100 or more copies). Enclosed is my remittance in full.

Name	Title.	
Company		
Address		
City	Zone	State

GLOVES ARE TOPS WITH LEADING UTILITIES



Charco's famous Flex-Saf linesmen's rubber gloves are first choice with top public utilities because they know from experience Charco gloves are always

- TOPS IN PROTECTION ... low leakage, high dielectric strength, snag-resistant, extra safety exceeding ASTM requirements
- TOPS IN WEAR...pure rubber treated by the exclusive Charco process for longer life, lowest cost per man-hour of use...
- TOPS IN QUALITY...controlled materials, dipped process, open steam curing and careful testing...
- TOPS IN DESIGN... curved fingers for comfort and flexibility, full size range for perfect fitting...

Write for catalog of complete Charco line of linesmen's and industrial gloves, sleeves, agrons, clamps, safety devices. Full stock of styles, or special designs to your specifications.

CHARLESTON RUBBER COMPANY

155 Stark Industrial Park, Charleston, S. C.

What Makes a Mailing Click?

Advertising men agree . . . the list is more than half the story. McGraw-Hill Mailing Lists, used by leading manufacturers and industrial service organizations, direct your advertising and sales promotional efforts to key purchasing nower.

nower. In view of present day difficulties in maintaining your own mailing lists, this efficient personalized service is particularly important in securing the comprehensive market coverage you need and want. Investigate today.



McGraw-Hill Publishing Co., Inc.

330 West 42nd St., New York 35, N. Y.

Through a new plan which I worked out and adopted, a customer may now rent the level of light which he requires. Through this plan the electrical contractor, if he also has a lighting maintenance service, may then become responsible for the installation of the lighting equipment, relamping, cleaning, electrical repairs, and maintaining the required level of illumination. But as the maintenance contractor, he owns the lighting system and is renting it to his customer.

By renting light, the customer makes no capital investment. His insurance cost is reduced, the cost of his light is an expense before taxes, his taxes are reduced and he relieves himself of all his lighting problems. And through this plan the electrical contractor can make a reasonable profit from his customer's potential losses.

In summary, the electrical contractor is the most logical person to be in the lighting maintenance service field. It is a natural adjunct of his basic business. Lighting maintenance service can fill in the valleys of low construction periods. And during times of slack business, it keeps his company's name on the spindle for other jobs. Just as lighting maintenance service is an adjunct of the electrical contracting business, so selling of lamps is closely related to lighting maintenance service; so selling electrical contracts can lead to lighting maintenance service contracts which can lead to selling lamps and vice versa (the cycle can start from either end and is extremely profitable regardless); and selling lamps can fill in the profit gaps when electrical contracting and lighting maintenance service business is



QUAD-CITY CONTRACTORS J. P. Krauth (left), White Electric Co., Moline, and W. J. McNealy, Electric Construction Co., Rock Island, discuss local construction activity status with George A. Crowe (center), new manager of the Quad-City Chapter, NECA, at Rock Island, Illinois.

WHERE TO BUY

Equipment, Materials, Supplies and Services for Electrical Construction— Maintenance—Repairs

WODACK "DO-ALL"® ELECTRIC HAMMER

A power tool of many uses for electrical contractors and plant maintenance work. Hammer is detachable from drill member. Drell's concrete 4, "to 1½" diameter, metat to 4," and wood to 4,". Forged hammer tools for chipping, channeling and cutting masonry materials. Attachment for right angle drilling.

Wodack® Electric Tool Corp.
4627 W. Huron St. Chicago 44, III.

STOP that WATER

With FORMULA NO. 540, a clear liquid which pentrates 4" plus in concrete, brick, stucce, plaster, etc. Seals out water, dirt. Holds 20' head. Use outside and in. Preserves all absorbent materials. Soil 14 years. Quick, "conomical, sure. \$3 in 55's. Free sample. See Sweet's. HAYNES PRODUCTS CO. OMAHA 3, NEBR.

LINDELL BORING FAST, EASY BORING

Drill attachment for easy boring in hard-to-reach places, overhead or below, without adjust.

Reduce

FITS ANY

Reduced speed for more power.

At your jobber, or write.

LINDELL ELECTRIC 115 East 58th Street Minneapolis 19, Minn

OPEN - CLOSE - LOCK: DOORS, GATES OPEN - CLOSE - LOCK: DOORS, GATES Commercial industrial RESIDENTIAL & SPECIAL With for Canadag ROBOT POPPLIANCES INC. ROBOT POPPLIANCES INC.

4 GOOD Habit

The Where-To-Buy Section of Electrical Construction and Maintenance supplements other advertising in this issue with these additional announcements of products and materials of special interest and application in the field of electrical construction, maintenance and repair work. Make a habit of checking this page each issue —a good habit!

CLASSIFIED

PROPOSALS, \$1.20 a line.

SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT . OPPORTUNITIES . EQUIPMENT—USED or RESALE BUSINESS .

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UNDISPLAYED RATE \$1.20 a line, \$1.20 a line, minimum 3 lines. To figure advance payment count 5 average words as a POSITIONS WANTED AND INDIVIDUAL SELL-ING OPPORTUNITY undisplayed advertising rate is one-half of above rate, payable in

BOX NUMBERS count one line additional in undisplayed ads. DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals). EQUIPMENT WANTED OR FOR SALE Advertisements acceptable only in Displayed Style.

DISPLAYED-RATE PER INCH:

The advertising rate is \$11.00 per inch for all advertising appearing on other than a con-tract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured % Inch vertically on one column, 3 columns—30 inches—to a page.

New ADVERTISEMENTS: address New York Office, 330 W. 42nd St., N. Y. 36, N. Y. for February issue closing January 22nd

OHIO MANUFACTURERS AGENCY

Well Established - Excellent Record

COVER ENTIRE STATE OR ANY PORTION OPEN

COMPLETE COVERAGE

WRITE TO

CAM NORTON COMPANY

2725 Derbyshire Road Cleveland 6, Ohio

BOOKS

ELECTRIC MOTOR REPAIRMEN!

ELECTRIC MOTOR REPAIRMENT

You will find Western's brand new book of more than 4290 Diagrams and Tables a valuable, time saving reference. Govern Split Phase, Capacitor (105 circuits), including special magnetic starting demices, dual voltage, two speed and various seer, seemed, seemed

E. A. WESTERN Box 1902 Phoenix, Ariz.

ELECTRICAL CONTRACTORS ESTIMATING HANDBOOK

"A Unique Tool of the Trade" WRITE FOR DESCRIPTIVE FOLDER TO THE ESTIMATOR PUBLISHING CO. 4102 Wilson Road Kenosha, Wis.

"SEARCHLIGHT"

Opportunity Advertising

-to help you get what you want.
-to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"THINK SEARCHLIGHT FIRST"

FOR SALE

23,000' of 3 Conductor 2/0 Steel Taped Parkway Cable, Type RJFJ, 3000 V, 3,500' of 3 Conductor #2 Steel Taped Parkway Cable, Type RJFJ, 3000 V.

- 3,500° of 3 Conductor #2 Steel raped Parkway Cable, Type njrj, 3000° v. 2-45 KVA, 2400 V. Primary 480/240 V. Secondary, 3 Phase, Dry Transformers 2-75 KVA, 2400 V. Primary 480/240 V. Secondary, 3 Phase, Dry Transformers 5-112½ KVA, 2400 V. Primary 480/240 V. Secondary, 3 Phase, Dry Transformers 3-100 KVA, 2300 V. Primary 460/230 V. Secondary, Single Phase, Oil Cooled
- 50 KVA, 2400 V. Primary 480/240 V. Secondary, Single Phase, Oil Cooled Transformers
- -100 KVA, 2400 V. Primary 480/240 V. Secondary, Single Phase, Oil Cooled Transformers
- 50—Misc. 2, 3, 5 & 15 KVA Single Phase Transformers. Also numerous switches. metal switch cabinets, 50 and 100 amp, cutouts, circuit breakers, etc.

Subject to prior sale

FRAZIER-DAVIS CONSTRUCTION COMPANY

1319 Macklind Avenue, St. Louis, Mo. Box 153-Grahamsville, New York

STerling 1950 Grahamsville 2861

ELECTRICAL CABLE

- for every industrial and power application. Special constructions. Odd lengths. Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers. Cut to length. Reasonably priced.

100

UNIVERSAL Wire and Cable Co. 2664 N. Clybourn Ave. Chicago 14, III.

WORLD'S LARGEST INVENTORY FREE

MOTORS-GENERATORS-TRANSFORMERS and Gueranteed Rebuilt 1 H. P. to 2500 H. P.

ELECTRIC EQUIPMENT CO. P. O. BOX 51, ROCHESTER 1, N.Y.

NEW BUILDING WIRE & CABLE

- SPECIALIZING in all types of weatherproof
- cable. Large stock of "shorts" in lead-covered and hard-to-get sizes. We also purchase your surplus stocks of wire and cable.

ACE WIRE & CABLE COMPANY lorgan Ave. Gl. 6-0904 Brooklyn 37, N. Y. 180 Mo

WANTED

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short Telephone: Eastgate 7-4778 PIERCE CABLE CO. 2664 Clybourn Ave. Chicago 14, Illinois



SEASON'S GREETINGS

On this, the Occasion of a New Year, Our Entire Staff Extends the Most Cordial Greetings to all our Friends and Customers . . . and hopes that their year '53 will be a prosperous and fruitful one.

HALL-MARK ELECTRICAL SALES CO. 542 Wortman Ave. . Brooklyn 8; N.Y.

Nightingale 9-7400

IN STOCK FOR IMMEDIATE DELIVERY

Every type & size of electric wire & cable, Under-ground cables for direct burial without pipes. Over-head wire, welding cable, abbetos cable, multi-conductor cords, elevator cable, high voltage cable, bare, triple braid weatherproof.

Eastern Electric Sales Co. 5425 Pennsgrove St., Phila., Pa. GR 4-5900

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DESIGN LEADERSHIP



Write for Bulletin 8538, SQUARE D COMPANY, 4041 North Richards Street, Milwaukee 12, Wis. THIS NEW SQUARE D

COMBINATION STARTER (SWITCHTYPE)

offers Greater Operator Safety

and Longer Motor Starter Life

switch Operating Mechanism provides maximum operator safety. Interlock prevents opening door when disconnect is on. When door is re-closed, self-aligning handle indicates true position of disconnect. Operating handle can be locked in the OFF position with one, two, three or four padlocks of varying sizes. Handle-locking mechanism also locks door.

Switch Design has quick make and quick break action—no dead center—visible blades for easy checking—magnetic arc plate for high rupturing capacity—dead-front line terminals, protected by hinged arc chamber cover—positive pressure jaws and fuse clips—non-tracking insulation.

Square D's time-proven design has always provided easy installation, simple maintenance, and long life.

Now, even longer life is assured by straight line, guided motion of armature and movable contact assembly which eliminates bearing and reduces wear. For added convenience and flexibility, Square D starters now have NEMA standard mounting and wiring.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS



SQUARE D COMPANY

FAST WAY TO WIRE NEW OR OLD PLANT

Ford Motor Company rewired plant, saved money, maintained production by using G-E No. 1799 varnished-cambricinsulated interlocked armor cable system



It's quite a feat to rewire a plant in a hurry, keep costs in line, and maintain production at the same time. But the Ford Motor Company did just this in their Canton, Ohio plant—they used General Electric's No. 1799 varnished-cambric-insulated interlocked armor cable system. All cables shown in the illustrations are 3-conductor, 500,000 CM for 15 ky service.

Installation speed—The ease and speed with which this interlocked armor cable system can be installed lowers costs. The cable can be laid quickly—indoors or outdoors—in long lengths, around corners, on *low-cost* aluminum *racks*. Engineering time is cut. Threading or bending of conduit is eliminated. Splices are of a simple mechanical type. Ford saved months, not days, because of these features.

Permanent—To our knowledge, no installation of interlocked armor cable has ever suffered mechanical damage sufficient to cause electrical failure. It is versatile as well as permanent and makes a neat, clean-looking installation. For more information about the G-E No. 1799 varnished-cambric-insulated interlocked armor cable system, write Section W57A-118, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Saves money at low voltages, too

G-E No. 1799 varnished-cambric interlocked armor cable also saves money at low voltages as indicated in the chart below.

Rated capacity 2000 amperes at 480 volts	Mat	of Critical erial 10 Feet	
	Copper	Steel	Cost per 100 Feet
Varnished cambric insulation in interlocked armor cable*	2375	1168	\$3000
Impregnated asbestos and varnished cambric in steel conduit	2781	4140	\$3954
Varnished cambric and braid in steel conduit	2781	4140	\$3966
Type RH rubber insulation in steel conduit	3475	4910	\$4660
Aerated bus-way	3000	990	\$4976

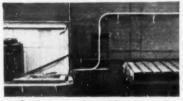
*Figures based on steel racks. Aluminum racks are normally used because they are lighter and easier to handle.



Cable being pulled around the first of 5 right angle bends of a 500 ft pull. Note racks can be hung from a roof projection and mounted on a stand.



A simple catenary suspension carries racks between buildings—underground construction is eliminated—cable on racks is always available for visual inspection.



Racks to carry the cable can also be mounted on the side of a building. This photograph shows 4 right angle bends.



Flexibility of interlocked armor cable is demonstrated here—corners and projections present no installation problems.

You can put your confidence in_

GENERAL



ELECTRIC